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Placers of Antioquia, Colombia

By Ralph W. Perry*

SYNOPSIS—Practically all the river gravels in the department of Antioquia, Colombia, are gold-bearing, but the greater part of the gold production comes from a few districts, especially from the Porce, Nare and upper Nechí valleys, where enrichment has been marked. Increased gold output may be expected during the next few years.

In speaking of the placers of Antioquia, Colombia, it is commonly said that there is not a stream in the department that is not gold-bearing; and while there are a few exceptions, this statement is practically true. The bulk of the gold, however, has been derived from a few of the many districts or from the rivers running through them. In other parts of the department, while "colors" can be obtained nearly everywhere, the deposits are not large enough to warrant work on a commercial scale, and these are either residual deposits or local concentrations of them. The majority of these deposits were worked out years ago, but some work is continually being done on streams in which the supply of gold is renewed each rainy season from the residual deposits.

The distribution of the profitable placer mines has been to a large extent determined by the past history of the country and its relation to the present topography and drainage. The original source of the gold has also been an important factor in this distribution, or rather in the relative richness of the deposits. The placers of Antioquia can be divided into four classes—(1) old placers; (2) recent placers derived to a large extent from class 1; (3) recent placers having no connection with class 1; (4) residual deposits.

LA CLARA HYDRAULIC MINE, OPERATED BY McGUIRE BROS., ON PORCE RIVER, COLOMBIA

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To class 1 belong the gravels of the Cauca River above Valdivia; also the old gravels occupying a considerable area in the central part of the department to the east and north of the City of Medellin. This area, at one time perhaps continuous, is now divided by the Medellin River.

These old gravels are now found around the towns of Rio Negro to the east of Medellin and Santa Rosa, Anorí and Amalfi to the north. Their former extent can only be conjectured, but there can be no doubt of their great size. The town of Santa Rosa is built on a small mesa made up of these deposits, and the small rivulets flowing from the town after a heavy rain carry gold in paying quantities. These deposits are generally low-grade, but there are some areas that would pay to work if water could be obtained, although most of them lie at a higher elevation than the present streams.

By some these old beds have been attributed to glacial action, but there seems to be no good reason for this belief, as there are no signs of glacial action and this area apparently has no relation to the region to the south where glacial action may have taken place. In Santa Rosa where the deposits are most extensive, they are stratified over a large area, and large portions of this area are composed of very fine material alone. The commonly accepted local belief is that this area was formerly a lake bed, and that the detached areas were river deposits derived directly from the erosion of the surrounding country and formed in rivers occupying courses somewhat different from those of the present streams.

The deposits near Anorí and Amalfi, which are now being exploited on a considerable scale, occupy depressions back of the ridges bordering the Porce River on both sides. Some are being worked by driving a tunnel from the Porce Valley and sluicing the gravel through this tunnel. Some of these deposits cannot be reached in this way, and it is hard to see how they can be worked, since they occupy depressions in the mountains where dumping ground cannot be obtained and are too deep for dredging, being 160 ft. thick in places.

They apparently have their gold distributed from the surface down, as the natives have washed much of the gravel near the surface. It is claimed that these gravels run from $0.30 to $0.50 per yard. Some of the basins contain as much as 35,000,000 cu.yd. and others, not measured, much more. A cross-section through some of these deposits near Amalfi shows their structure and relation to the Porce River.

The old gravels of the Cauca Valley occupy the present valley of the Cauca above Valdivia, extending to the vicinity of Anza. These beds are extensive and of great thickness (300 ft. or more) in places. They are poor, especially in the lower end of this area, but there are probably parts of the area that can be profitably dredged.

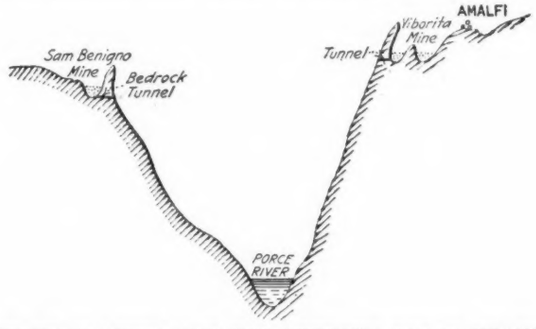
Original Source of Cauca Gold

The deposits of the Cauca have apparently derived their gold from a source distant from the present situation of the placers and entirely distinct from the area in the central part of the department. It is likely that the source of the Cauca gold must be sought in the country surrounding Manizales and the Quindio mountains to the south, before the eruptions of the Quaternary period buried that part of the country with the eruptives that are now found there. For this reason, the placers of class 2 on the lower Cauca have not been enriched by additions of gold from any other source.

The old placers in the other area were formed in the immediate vicinity of the source of the gold. This part of Antioquia is highly mineralized, having large areas with stringers and lenses of gold-bearing quartz so close together that they have formed residual deposits of sufficient importance to be worked on a large scale, where favorably situated in regard to water for hydraulicking. All of the small streams in this area carry appreciable quantities of gold, and it is the addition of this gold that has greatly increased the richness of the Nare and Porce Rivers in comparison to the Cauca.

Recent Placers Derived from Old Gravels

In class 2 are the mines of the Cauca below Valdivia and those of the Nare, Porce and Nechí Rivers. These mines on the Cauca are amenable to dredging, but no exact information concerning their value has been obtained except by the few companies that have drilled some areas there. Much time and money have been spent in drilling the lower parts of both the Cauca and Nechí Rivers. None of the companies seem to have taken into consideration the fact that gold is seldom found far from its source except in streams of considerable velocity. If there was any good reason for believing that the lower parts of these rivers had formerly had a greater gradient than at present, there would be some ground for seeking



ANCIENT PLACERS AND THE PRESENT FORCE CHANNEL

gold there, but as both rivers have a comparatively steep gradient down to Caceres on the Cauca and Zaragosa on the Nechí, it is most probable that the amount of gold found below these towns will diminish. Moreover, as the gold in these valleys has been derived from the reconcentration of the old deposits, it is inconceivable that the whole extent of this gravel could be enriched beyond its original content.

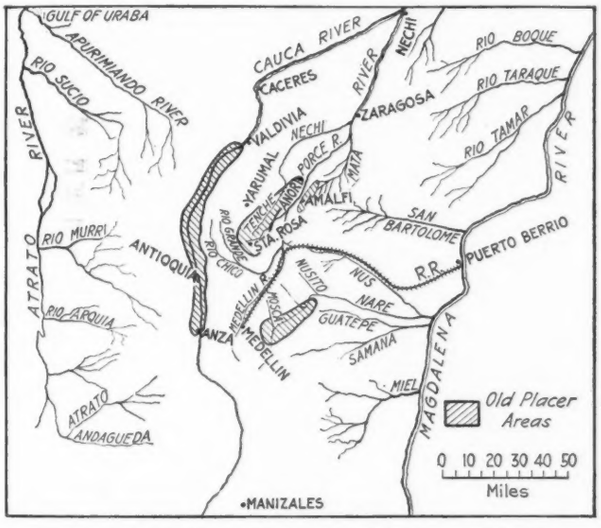
The fall in the Cauca River from Caceres (El. 205 m.) to Nechí, where the Nechí River joins it, is 50 m. in approximately 150 mi. Between Valdivia and Caceres, the Cauca receives numerous small tributaries that are gold bearing, and it is probable that these have played a part in enriching these deposits. They will also account for the variations found in the character of the gold at different points. Some of these streams furnish coarse gold derived from the quartz lenses in the schists which cover a large area there.

Porce and Nechi Rivers

The Porce and Nechí Rivers are treated as one since they both drain the Santa Rosa district, have their source there and join again a short distance above the town of Zaragosa, below which place they are called the Nechí. The Porce River is formed by the junction of the Medellin River and the Rio Grande. The Medellin River has

produced some gold in the past, but most of the gold of the Porce River has come through the Rio Grande. This river and its important tributary, the Rio Chico, are gold-bearing from their sources. Each has its source north of Santa Rosa and, after long circuitous courses, they come together south of Santa Rosa and flow north parallel with the Medellin River, finally joining it to form the Porce. The Rio Grande and Rio Chico rise at an elevation of 8,500 ft. and placers are found throughout the course of each wherever the gradient permitted them to form. These deposits have now been exhausted except in some places in the bed of the river. They were small but exceedingly rich. About 8 mi. above the mouth of the Rio Grande, at an elevation of 3,200 ft., begin the placers properly belonging to the Porce River.

Following the windings of the Porce River for a distance of approximately 25 mi. is to be found the richest placer ground in Antioquia. A conservative estimate of the amount of gravel in this area is 130,000,000 cu.yd. All of this gravel carries from $0.20 per yd. up, and the areas mined to the present time have averaged over $1 per yd. According to the indications in the mines worked,



PLACER DISTRICTS NEAR ANTIOQUIA, COLOMBIA

the richest part is in the present bed of the river. The ground in La Clara mine, which has been most extensively worked, has been better than this, but McGuire Brothers have not worked any more of the low-grade gravel than they could help. Neither have they mined more than a small portion of the river bed, and that near the banks. Preparations have been made this year, however, for the diversion of the river and mining the bed. Much poor ground has been mined in the search for the rich streaks. The average depth of gravel is 40 ft. In some places it is nearly 70 ft. deep. The bulk of the gold is found in narrow channels up to 25 ft. wide and within a few feet of bedrock. One peculiarity of these channels is that as bedrock rises they become poor; in other words, the richest spots are on bedrock sloping downstream. These gravels carry gold close to the surface and at a depth of 10 ft. generally carry $0.20 per yd. From this level there is little increase in value until a few feet above bedrock, and the existence of the rich channels is not indicated until they are reached. The bedrock over the entire area outside of the channels is generally rich enough to bring the average of the whole area to $0.50 per yd., exclusive of the contents of the rich streak. It is to be regretted that some accurate records of the contents of and costs of working these comparatively low-grade gravels have not been kept.

The operators of La Clara mine, which is the best equipped on the river, estimate that no ground running less than $0.50 per yd. can be handled at a profit. It would seem that this estimate is large, as it covers delays caused by working close to the river in pursuit of the best ground. Frequent periods of high water make work close to the river dangerous, and it is only successful in the dry seasons. The river can sometimes be crowded back by dumping the gravel elevated on the edge of the river and gradually forcing the river back. When successful the gravel mined has run several dollars per cubic yard, but the area mined has been small.

Rich Gravel in Gavino Mine

The Gavino mine just above La Clara was the richest mine worked on the river for its area, having produced over $200,000 from an area 300 ft. long by 200 ft. wide. About 75% of this production came from a narrow channel 15 ft. wide by 150 ft. long, the remainder of the ground mined not running over $1 per cu.yd. This mine was worked by natives, and the gravel was carried out by hand and washed in small, short sluices. A small elevator was used to pump out the water. The greatest depth to bedrock was 65 ft. Several years were spent in working this small amount of ground.

The reason against the use of dredges in this section of the river is the difficulty of moving them from one playa to another, as the playas are small, running from 2 acres, like the Gavino, up to 50 acres. They are generally separated by rapids. High water would also interfere with successful working. Otherwise the ground would seem to be favorable for dredging except where large boulders are encountered. Much of the gravel can be handled through an elevator with an 8-in. throat and the bedrock is a soft decomposed gneiss or granite. Power could be secured within short distances. Unless dredging is undertaken much of this area will never be worked, as it is impossible to secure water under sufficient head for elevators. Below here the Porce runs through a narrow deep valley until it approaches Zaragosa, although there are numerous deposits of gravel in this section that are large enough to work. These have the same characteristics as the deposits already described, and present the same difficulties, but they are more difficult of access.

In this part of its course, the Porce receives two important gold-bearing tributaries, the Guadalupe, which has produced much gold and has its source in the immediate vicinity of Santa Rosa, and the Mata River from the Amalfi district. The Guadalupe River has been worked in all its course, and washings are carried on every year in its bed as the gold contents of the bars are renewed each year. Most of this washing is done by women who make from 10c. up per day. Near the Porce, the Guadalupe makes a sheer descent of 1,000 ft. into the Porce Valley, and below this fall its course is comparatively level for several miles, until it flows into the Porce. This ground should be rich, but it has never been drilled and contains many large boulders. The Mata contains some large deposits and it has been claimed that they are of a grade that can be worked at a profit.

The Nechí River under the name of the Tenche rises a few miles northeast of Santa Rosa and flows north, receiving many gold-bearing tributaries from the towns of Angostura, Yarumal and Anorí. There has been much gold produced from this river in the past, and many of the mines have been extremely rich. I am not familiar with the lower part of this river, but I am told that there are deposits of gravel there of good size; they should be similar in contents to those of the Porce. It is below the junction of the Nechí and Porce Rivers that dredging operations have been undertaken profitably. Both dredges that have been installed there have been successful and the area that will be profitable appears to be big. Additional dredges are being installed. Most of the dredging ground will probably be found in the vicinity of Zaragosa, as drilling operations farther down near Nechí have not proved any good ground and the gradient of the river is too small to have transported much gold that distance.

Old Gravels in the Nare Valley

The Nare River also has a large part of its upper course in old gravel deposits, and next to the Porce is the most important source of gold in the department. Like the Porce it not only has received the benefit of the accumulated gold of the old placers, but it has been greatly enriched by numerous tributaries draining a highly mineralized country. Its most important tributaries are the Mosca, Conceptión and Nusito. Each of these streams has produced much gold in the past and formed large deposits at its mouth. These deposits have been worked out with the exception of that at the mouth of the Nusito.

In this part of the Nare River is found a deposit that is comparable in area and richness with that at the mouth of the Rio Grande. There is a great similarity in both the gold found in the Nare and Porce Rivers and in the distribution of the gold.

The Nare has the same rich narrow channels and about the same gold content in the rest of the playas. Here also the richest part of the deposits lies in the present river channel. The Nare has a wider valley than the Porce, and it is therefore more difficult to secure water with sufficient head for elevators. The river has a large production each year from bar workings, whenever low water permits. There has been little work done on this river in comparison with the Porce, but where bedrock has been reached good results have been obtained. The gravel has about the same average depth as that on the Porce River. The gold of the Nare and Porce is found in flattened grains up to ¼ in. diameter, but generally smaller. Its fineness is from 820 to 840, and the gold from the Nare averages a little higher than that from the Porce. In the latter some platinum is occasionally found. This has come from the Santa Rosa district, where platinum has been found in some of the ore, according to Boussingault. Coarse gold is seldom found in either of the rivers, but is sometimes washed out of the banks of the Porce after a flood. Boulders are absent from the Nare gravels, except where dikes of hard rock are found cutting the gneiss and granite of the bedrock. The area at the mouth of the Nusito is probably more suitable for dredging than any area on the Porce. High water would be the only drawback.

Little drilling has been done on any of these mines, and it is doubtful if it has either proved or disproved the richness of these deposits, as closer drilling than is customary in a preliminary examination is necessary, or one of these channels would be missed and the whole drilling be without value. In fact, the operators of La Clara mine on the Porce place absolutely no confidence in drill results, but it would seem that close drilling would be of distinct advantage in locating these channels.

Placers of Recent Formation

In class 3—deposits having no connection with the old gravels—are included all the rest of the true alluvia of Antioquia, those of any importance being found on the San Bartolome, Nus, Samana, and Miel Rivers and the tributaries of the Atrato, which will not be considered on account of lack of knowledge concerning them.

The tributaries of the Samana and Miel have produced considerable gold in the past, but the deposits in the rivers themselves have never proved to be of much importance. These tributaries have their source in a country that is only slightly mineralized and characterized by an almost complete absence of gold-bearing stringers over any considerable areas. The one exception to this statement is the Guatepe River, but this stream flows into another river before it reaches the Samana, and it is doubtful if any of its gold has ever reached the latter river.

The Nus and the San Bartolome are the only two rivers of this class that are of any importance. The upper part of the course of each is through a country most favorable for the formation of placers, the Nus especially draining a district well known for its large residual deposits. The country drained by the San Bartolome is not so favorable, but it has the benefit of numerous tributaries larger than those of the Nus, and its gravel deposits are correspondingly larger and perhaps richer. The deposits of the Nus are shallow compared with the Porce and Nare, and the gold is more evenly distributed both vertically and horizontally. Water is generally available within reasonable distances and under sufficient head for elevators. These mines are worked by native methods, but with indifferent results. Not being as rich as the Porce or Nare, they attract little attention, although they should pay well with elevators. The Nus has few tributaries of any importance, the chief one being Las Animas, which has a good-looking deposit of gravel that pans well.

The San Bartolome has several important tributaries that have good deposits of gravel. Some of these have been highly productive, and others as good will doubtless be found. As in all of these streams, the only mines that have been worked have been those where water was easily obtained; and, with the exception of a few localities on the tributaries of the San Bartolome, it is difficult to obtain water with sufficient head. Dredging seems to be the only practicable method of working the mines on this river and some drilling of large areas to determine their value is now being done by Medellin men. The lower deposits of gravel will probably prove too poor to be worked, as those in all the other rivers have done; but the area in the vicinity of its tributaries will undoubtedly be worth developing.

There are numerous residual deposits scattered over the whole department, but the largest are found in the districts of Santa Rosa, Guarne on the Mosca River and in the Nus Valley. In these districts the deposits cover large areas and the aggregate quantity of gold produced

from them has been large. With the exception of those on the Nus, they are so situated that it is difficult to secure enough water to work them on a scale commensurate with their size. It is only during the wet season that water can be obtained, and after years of work the amount of ground washed has been insignificant.

A great many of the small quartz mills of the country are run on the ore left behind after sluicing these deposits. The small streams in the vicinity are steadily worked in the wet seasons and furnish a means of livelihood for thousands of people. Las Animas and Retiro mines at Providencia have maintained a steady output of gold for years and the creeks below their mills carry gold, but its fineness and the slime present have hindered all attempts to save the gold. In these mines the hills are sluiced away with water under no head, and the rock from the stringers and veins is collected and sent to the mill.

In a section 200 ft. wide, I have seen in the Retiro mine a dozen stringers of ore and two veins over 2 ft. wide. Not all of this ore carries gold enough to pay for milling, and only enough sluicing is done to keep the mills running. In the case of the Retiro mine, the sand from the creek below the sluices is collected and crushed again in a stamp mill through a coarse screen and a recovery running from $0.50 to $2 per ton is made. It is the steady addition of the gold resulting from the erosion of these residual deposits to that derived from the old gravels that has made the Nare and Porce Rivers much richer than the Cauca, whose original source of gold has been buried. The Cauca still has tributaries draining such sources of supply in the Quindio country, but if this gold ever reaches the Cauca River it is deposited in the upper parts.

Few Unexplored Areas in Antioquia

The only part of Antioquia where there is any chance of discovering new placers is on the tributaries of the Atrato, which region is comparatively unsettled on account of its climate. Even here it will be found difficult to locate mines, as most of the desirable ground has been taken up and would have to be purchased or leased. Practically the whole courses of the Porce, Nare, Nechí and Cauca have been titled, as well as the desirable deposits on the Nus and San Bartolome. There may be fractions of claims on these rivers that can be secured, owing to mistakes in the measurement of claims.

The small tributaries of these rivers have furnished the bulk of the placer gold produced in the department to date, but their production at present is small, most of the deposits of any importance having been worked out. It is generally a waste of time to examine any of the deposits on these small streams, even if they show no signs of having been worked previously. The old inhabitants of the department recall times when even rivers like the Porce carried so little water that work could be done in its bed, and while these larger streams with their deep bedrock could only have been worked to an insignificant extent, little gold has been left in the others. The work done in the rivers during the dry seasons has served to prospect them, and the native miners generally have a good knowledge of the situation of the richest ground.

All of the gravels on the lower Cauca, Nechí and San Bartolome are suitable for dredging and few of them can be worked in any other manner on account of the lack of water under sufficient head. The old gravel deposits of the Cauca River are generally too poor to be worked by any method, but there is one tract there covering an area of from 15 to 20 sq.mi. on which panning over a large part of this area has indicated a gold content running from $0.10 to $0.80 per cu.yd. There is sufficient water for dredging, and power could be obtained within reasonable distances.

The climate on all of these rivers is hot, and malaria is prevalent, but the fact that work is being steadily done there shows that the climate is not an insuperable obstacle. The mines on the upper Nare and Porce at an elevation of 3,000 ft. are afflicted to a less extent with malaria; the nights are cool and malaria can be avoided if ordinary precautions are taken.

There is no dredging ground on the Nus River, unless it be in its lower part, and I do not think there is gold enough present there for profitable operations. The dredging ground on the San Bartolome is somewhat difficult of access, and roads would have to be built for the introduction of machinery. This same condition is found on the Nare, but the best ground on the Nare is about 15 mi. from the railroad.

Abundant Water Power May Be Utilized to Pump Water for Hydraulicking

The most favorable tract on the Porce for dredging is the area at the mouth of the Rio Grande. This lies within a few miles of the railroad. These deposits so far have been worked only by hydraulic elevators, and this method will probably continue to be used. There is little water available and unless some of the smaller holdings can be consolidated to permit the construction of long ditch and pipe lines, they will remain idle for a long time. Ditch lines can be built cheaply but their maintenance is costly, on account of the nature of the ground, and the heavy rains.

Power can be developed cheaply from the river itself, and probably in the end these mines will be worked by means of heavy pumps and elevators. I see no reason why this method should not be successful, and undoubtedly it would require less capital than getting water on the mines through ditch lines.

All of the operators on the Porce and Nare have hopes of turning the flow through the ground worked out and thus being able to mine the bed of the river. If they succeed in doing this the yield will probably equal that of any ground ever mined in the department.

I would consider it a waste of time to investigate any mines that are not situated on the Cauca, Nare, Nechí, San Bartolome, Nus and Porce Rivers if one is looking for a large operation. Some of the tributaries of these streams offer good chances for the man with a small capital; but even there the best ground, situated where water could be obtained, has been worked. Regardless of new discoveries, the output of gold from Colombian placers will show a large increase in the next few years from the dredges near Zaragosa and the elevators now being installed on the Porce River.

The Deutsche Molybdänwerke at Teuschenthal near Halle on the Saale has been greatly enlarged and improved so that it will be able to supply the whole European steel industry with molybdenum metal and ferromolybdenum when peace is restored, according to "Zeitschrift für angewandte Chemie." The company owns mines producing an abundance of the raw material.

Geologic Conditions That May Confuse Oil Drillers

By Dorsey Hager*

Oil geology became a science only when the relation between underground and surface folding was clearly established; when it was found that surface folding reflected underground folding. This truth was arrived at by the plotting and the mapping of many well logs, and also by many observations taken in highly folded regions like California and Wyoming, where folding can be readily photographed and traced for depths of several thousand feet.

However, even though a geologist does find well-defined folds, there are a number of conditions under which the drill may fail to find oil, but which the geologist cannot foretell. A brief résumé of such conditions may lead to a clearer understanding of the geologist's limitations. The following factors all contribute to make oil-field work uncertain: (1) Faults; (2) unconformities—(a) angular, (b) erosional; (3) lensing—(a) due to thickening of beds in flat strata; (b) due to pinching out of sand; (4) hard spots or lack of porosity; (5) basalt intrusions; (6) water in anticline in place of oil; (7) shales at top of anticlines; (8) barren.

Hidden faults or breaks in the strata may make a region spotted. Where the strata have been broken, as in Fig. 1, wells Nos. 1 and 3 may carry oil, while Nos. 2 and 4 are barren. This faulted condition may not show at the surface, but drilling will in time prove its existence.

Angular unconformities (see Fig. 2) may result in a lack of production in a fold. Well No. 1 is barren; No. 2 is productive. Were No. 1 drilled first, the field would perhaps be abandoned. Were No. 2 drilled first, later developments at No. 1 would prove disastrous. Such a condition is the result of folding or tilting of the beds prior to the later deposition and folding.

In the erosional unconformity (Fig. 3) wells Nos. 1 and 4 are productive; Nos. 2 and 3 are barren. Such a condition is due to the erosion or washing of the earlier beds before the later beds were deposited upon them, leaving an island-like condition.

Lensing is the cause of uncertain conditions. Sands often change to shales, or *vice versa*. This may result in a humped condition, as shown in Fig. 4, in which the oil rises to the top of the lens or hump. Wells Nos. 1 and 3 may be practically dry, while No. 2 is a good well. Such a condition may account for oil in practically flat beds.

Fig. 5 shows the beds lying at an angle. The sand pinches out up the dip, resulting in an accumulation where there is no pronounced folding to break the normal dip. Wells 1 and 3 are barren. No. 2 is productive.

Fig. 6 shows the sand locally hard at the top of the fold. As a consequence well No. 2 is dry, though oil occurs on the slopes at Nos. 1 and 3. A similar condition may exist where the top of the structure carries gas and no oil. In Mexico dry spots are sometimes due to the occurrence of basalt intrusions. One drills into basalt as at well No. 2 and obtains dry holes, but in Nos. 1 and 3 oil is found.

Water may also occur at the top of the structure in place of oil. Shales may replace sands that one might expect on the axis of a structure, and one would find the fold barren. Again, there may be an excellent fold, but the age of the formation and its history are against its carrying petroleum. However, taking all adverse factors into consideration, one will find nine out of 10 folds in oil regions productive. Even though adverse conditions do exist, the tops of the folds are the best places to drill.

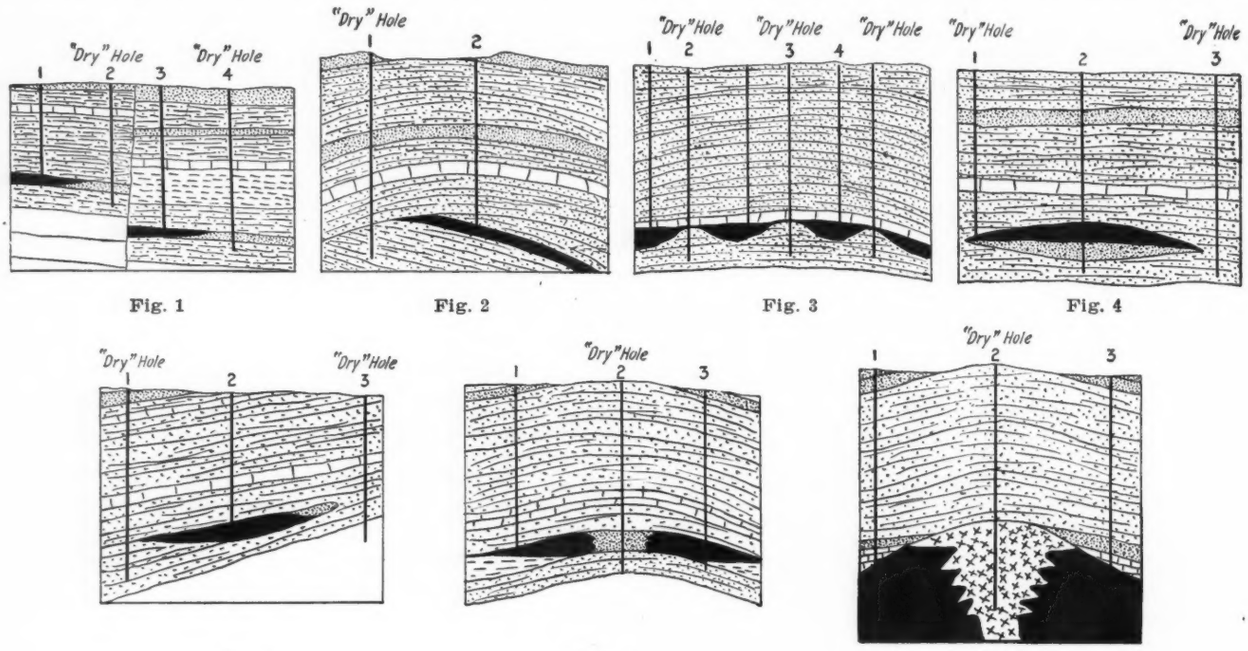


Fig. 1 Fig. 2 Fig. 3 Fig. 4

Fig. 5 Fig. 6 Fig. 7

FIGS. 1 TO 7. GEOLOGICAL CONDITIONS THAT UPSET THE OIL-WELL DRILLER

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Cryolite Imports Into the United States in 1914 amounted to 4,612 long tons, as compared with 2,559 long tons in 1913, according to the U. S. Geological Survey. No cryolite is produced in the United States, the entire supply used in this country being imported from Ivigtut and Eskimo Hamid on the southern coast of Greenland.

Use of Coal Tar in Flotation

By William A. Mueller*

SYNOPSIS—Experiments have shown that coal tar, while not usually a good flotation agent, serves as an excellent base for use with frothing oils, reducing the required quantity of the latter. Coal tars differ, and some are of no use, while others are applicable only to certain kinds of ore. Experimental results and practical operations are discussed.

In this discussion of the use of coal tar as an agent for mineral flotation I do not wish to advocate its universal use but merely to state a few facts and give a few results that I have secured experimenting with it as a flotation agent with a porphyritic copper ore of the Southwest. Furthermore, all references made to flotation in this discussion apply only to the flotation of copper-bearing sulphide ores. No attempt is made to discuss the action of any others at this time.

Character of Oils Used in Flotation

Every flotation plant finds an oil particularly suited to the ore being treated. There seems to be no one oil that will give satisfactory results in every case. Coal tar may, however, become a universal oil when employed as a base for making good working mixtures of oils. I feel that a great many of the expensive oils now in service could be reduced in quantity if combined with a large part of coal tar.

The principal oils utilized for flotation in this country for copper ores, up to a year ago, were wood-distillation products and, at one plant, cresol. The price of cresol, about 30c. per gallon, made its use costly (even though only 2 lb. of oil per ton of ore was needed) as compared with coal tar, which costs only about 5c. per gallon. Later, other coal-tar products less expensive than cresol came into notice, and finally coal tar itself, aided by some frothing agent such as pine oil. The latter, however, is also very expensive, and subsequent experiments showed that coal tar with from 10 to 25% creosote gave equally good results. Until these experiments coal tar was not considered as a flotation agent in this country, nor ever experimented with here, so far as I could find out, although mentioned in some English patents. The experiments referred to led to its adoption in one large mill, and many others are now experimenting with it and getting good results.

Tars Are Products of Gas Works

There is a great deal of difference in the behavior of the different tars, and those used in these experiments, while classed as coal tars, are really gas tars or the tars resulting from the manufacture of gas. They are byproducts and can be had reasonably cheap. In the case of tar No. 1 (Table 1) no special heat treatment was followed, as it was a product made in a small iron retort for test purposes only, before other tars could be secured. In this case the coal was heated in the retort until no more gases came off, the volatilized products were passed through a condensing system and the gas allowed to escape. The total condensed liquids, including the water, were collected and called tar No. 1. No. 2 was the same as No. 1, except that the water was removed by settling and decantation. The other tars used were crude products, as far as I could ascertain, and all were classed as byproducts of gas or coke plants in different parts of the country.

No attention was paid to the manner of making the tar, as a byproduct as inexpensive as possible was wanted; hence the heat treatment of the coal from which the tar is a product was not considered, nor were some of the other facts entering into the making of coal tar as a byproduct. Of course by special heat treatment and attention a coal tar can probably be made that will suit the purpose of flotation better than the material now employed; but whether the extra cost would warrant such procedure is doubtful, particularly when the gas and coke problems are considered. As a matter of comparison of the various tars, a distillation test was made on the samples at hand. The results were noted in Table 1.

TABLE 1. DISTILLATION PRODUCTS OF VARIOUS COAL TARS

Distillate	Tar No. 1	Tar No. 2	Tar No. 3	Tar No. 4	Tar No. 5	Tar No. 6	Tar No. 7
20°C.–110°C., light naphthas and water.	.....	.....	1.2% mostly water. Oil, light brown and thick.	2.8% oil, light brown and thick.	None	None	None
110°C. – 170°C., light oils.	.....	.....	1.2% oil; yellow color.	0.4% yellow color, very gummy.	0.4% oil; clear, pale, yellowish green.	0.3% solid; reddish color.	2.0% light yellow-colored wax.
170°C. – 210°C., second light oils.	.....	.....	1.2% oil; yellow color.	0.2% light-brown, solid.	1.1% yellow solid.	0.2% light-yellow solid.	1.0% yellow solid.
210°C. – 240°C., carbolic oils.	.....	.....	7.5% yellow clear liquid.	6.8% white crystalline.	9.1% yellow solid.	2.0% light-yellow solid.	3.2% yellow solid.
240°C. – 270°C., creosote oils.	.....	.....	7.4% reddish-yellow liquid.	4.8% white solid.	8.4% yellow solid.	6.0% yellow solid.	8.1% dark reddish-brown solid.
270°C. – 360°C., anthracene oils.	.....	.....	24.3% yellowish-brown liquid to red-brown solid.	14.4% yellow solid to reddish-brown solid.	25.9% yellow-brown to light-brown solid.	20.3% yellow to brown solid.	23.5% dark reddish-brown solid.

Tars Nos. 1 and 2 were in small quantities, hence no test was run on them. Tar No. 1 was the same product as Tar No. 2, except that the latter had the water removed. Both tars were made from the same coal as was used for Tar No. 3. The analyses would in all probability be the same for Tar No. 2 and Tar No. 3. Tar No. 1, however, would give a larger amount of the first fraction because of excess water. Where the fractions became solid no condenser could be used in distillation, hence there was probably some loss by volatilization.

Character of the Ore Used in Experimenting

The ore, as has been said, was of a porphyritic nature, carrying about 1.60% copper, mostly chalcocite, with some chalcopyrite, and about 0.15% oxide.

At times this ore carries more clayey material than at others, and this fact makes a big difference in the results obtained, since it tends to lower the grade of con-

*Inspiration Consolidated Copper Co., Miami, Ariz.

centrates as well as to raise the copper contents of the tailings. The reason for this is not altogether clear, but it is reasonable to say that the clayey material coating the mineral particles keeps the oil from adhering to them, hence preventing its flotation as clean mineral.

The ore for each test is ground in an Abbé porcelain ball mill for the time necessary to reduce it to a fineness of less than 1.5% on a 48-mesh screen. The oil can be added either before or after grinding, but it seems to do better when added before and ground wet with about

ANALYSIS OF COPPER ORE

Silica	72.0%
Alumina	20.0%
Iron	3.0%
Copper	1.6%
Sulphur	2.0%
Lime + magnesia	0.7%

1 part ore to 1.3 parts water. Grinding with tar gives much better mixing and more intimate contact of tar and mineral than would otherwise be secured. If the tar is not thoroughly mixed with the ore, it will be found floating in globules on the pulp, and will not mix. Even agitation, unless very violent, will fail to break up the globules.

Method of Making the Flotation Tests

For the flotation a small two-compartment machine was used. One compartment comprised the agitation mechanism, which agitated pulp by means of a stirrer. This agitation compartment was connected with the other compartment (the spitzkasten) by a narrow slit near the bottom and a large opening near the middle. This enabled the aërated pulp to flow from the agitation into the next compartment, where no agitation took place. The froth rose to the surface and was skimmed off with a spoon or a spatula. The test was not complete until no more mineral-bearing froth was formed. The capacity of the machine was about 2,000 c.c.

For each experiment the time of flotation was noted, this being the period from the beginning of flotation until no more mineral-bearing froth formed in the machine. In all experiments the first product formed was called concentrate, and when this no longer came off, turpentine was added, and the next product was called middlings. This system corresponds to that followed when the ore goes through the Minerals-Separation type of machine, where concentrates are formed in the first few compartments, then turpentine added, and the later products taken off as middlings and retreated, either in the same machine or a similar one.

At the time of adding the turpentine the coal tar would often be brought to the surface in flaky particles which would stay afloat, but this made no difference, as the concentrates had already been taken off. The particles brought up seemed to be some of the insoluble portion of the tar, known as pitch, which does not have any apparent effect on the flotation when excessive. In some cases when tar was mixed with other oils the tar separated in the pulp before any flotation took place. This trouble, however, can be avoided by sufficiently grinding the pulp to the right consistency. The tar will be better mixed in a thick pulp than in a thin one. Whenever the tar separates there is a fault somewhere, the correction of which should prevent further trouble. A mixture wherein coal tar constitutes 80% of the whole now gives good results and separates very little.

Coal tar itself does not froth well. That is, the froth obtained from coal tar alone is very lean, although of good quality. For satisfactory results with coal tar alone the ore must be tied up in the machine for too long a period, and for this reason it is advisable to add a small amount of oil that has great frothing characteristics. Pine oil was the first to be employed for this purpose and has given satisfaction. The price of pine oil, however, is high and its use should be avoided when possible. Coal-tar products, such as cresol, creosote, etc., which formerly served alone, are now mixed with the coal tar to about 20%. The mixture thus obtained is excellent in both the pneumatic and agitation types of machine.

Coal tar alone gives low-grade tailings together with high-grade concentrates if the ore is treated long enough. Test B (Table 2) shows this. Here coal tar used alone, when floated for 45 min., gives concentrates assaying above 38% copper and tails 0.21% copper, of which 0.15% is oxide, thus leaving but 0.06% sulphide copper. In this case the concentrate plus the middling gave a product assaying 24%.

As a comparison with coal tar, the results of the same ore treated in exactly the same manner and under the same conditions (except cresol instead of coal tar) were used. Cresol was chosen only because it was the oil serving in the larger plant at the time the coal-tar experiments were made, and it was against this agent that coal tar was being tried out.

Of course all coal tars will not be found adapted to one ore, and there are probably some that are worthless for any ore. As the results show, some of the tars were useless, while others served admirably. Tars Nos. 1, 2 and 3 were from coals produced in the same field, the others being from coals of different fields, which fact may have some significance.

A tar may not give any results at all when used alone, but as soon as a very little of such an oil as pine oil is added, results are often obtained immediately. The amount of oil will vary according to the ore, grade of concentrates and tailings desired; 0.005% of it will work wonders on ore experimented upon. A large amount is beneficial to a certain point, when further addition is considered detrimental, as the grade of concentrates is lowered as the quantity of oil is increased. Of course the value of the tailings is lowered as well. It is a question of lost mineral against excess smelting charges on the concentrates.

Proportion of Tar Determined by Experiment

To produce good results both as regards concentrates and tailings, a certain amount of tar must be used, and this amount must be determined for each ore individually. More or less will be determined. For instance, Table 3 gives some idea of the proportion of tar to mineral that produces the best results. Other oils act in a similar manner.

In tests on three different kinds of tars we have, in Table 3, the comparisons of varying amounts of tar, the pine oil remaining a constant quantity with regard to its relation to ore. As the amount of tar increases in proportion to pine oil the amount of concentrate increases and the copper content of the tailing decreases. This may be on account of the proportion that coal tar bears to the mixture, or it may be because of the amount of oil resulting from increasing the amount of coal tar. In

every case the oils were introduced from a dropping-bottle and each drop meant about 0.005% of the weight of ore taken, so that as the mixture became richer in tar it also increased in bulk. To determine this fact the amount of coal tar was kept constant, while the quantity of pine oil was varied. This series of tests showed practically the same results as were secured by varying the tar; hence it must depend upon the amount of mixture employed. It seems to make no difference which we vary, so far as results are concerned, the prices of the products being the determining factors. The amount of oil required in every case is less than 0.1% of the ore, or a little less than 2 lb. per ton. These facts are confirmed in the commercial plant. More oil than this determined percentage leads to excess froth, which is hard to handle. Mixtures of coal tar with other frothing products have an effect similar to the pine-oil mixture. Along these lines there is a great amount of work being done, but until it is all ready for comparison there can be no comprehensive conclusions drawn.

TABLE 2. EFFECT OF VARIOUS TARS ON THE SAME ORE

Grams Concentrates	Time, Min.	Grams Middlings	Time, Min.	Copper in Concentrates, %	Copper in Concentrates and Middlings, %	Copper in Middlings and Tailings, %	Copper in Tailings, %	Tar No.	Test	Recovery Concentrate and Middlings, %	Recovery Concentrates, %	Remarks
32.0	60	12.0	15	29.3	24.2	0.40	0.22	1	A	88.7	78.2	Tar for concentrates, turpentine for middlings. Results are the average of three tests.
18.0	45	22.0	40	38.9	24.0	0.56	0.21	2	B	86.3	63.0	Tar for concentrates, turpentine for middlings. Results are from one test.
32.0	35	14.5	25	28.2	21.2	0.27	0.17	2	C	90.4	82.6	Tar: pine oil = 1 : 1 (mixture). Results are the average of two tests.
20.0	50	16.5	20	29.6	23.4	0.58	0.25	2	D	79.4	56.3	One drop (about 0.004%) turpentine added concentrates in addition to tailings. Results are the average of two tests.
11.0	40	18.0	15	21.2	26.6	1.15	0.43	3	E	68.3	20.7	Tar for concentrates, turpentine for middlings. Results are from one test.
28.5	15	25.5	18	30.0	18.1	0.38	0.22	3	F	86.0	75.8	Tar: pine oil = 1 : 1 (mixture). Results are the average of two tests.
8.5	50	24.5	25	22.0	23.9	1.18	0.38	4	G	73.7	34.5	Tar: pine oil = 1 : 1 (mixture). Half of mixture added before grinding; half after. Results are the average of two tests.
10.5	50	22.0	15	25.2	21.5	1.17	0.46	4	H	62.7	23.4	Tar: pine oil = 1 : 1 (mixture). All air added in mill. Results are the average of two tests.
13.5	50	23.0	25	28.6	21.1	1.00	0.48	5	I	67.2	33.7	Tar: pine oil = 1 : 1 (mixture). Half of mixture added before grinding; half after. Results are the average of two tests.
21.0	50	21.0	15	25.4	21.4	0.83	0.35	5	J	80.1	47.9	Tar: pine oil = 1 : 1 (mixture). All oil added in mill. Results are the average of three tests.
12.0	20	45.5	20	33.2	15.3	0 98	0.34	6	K	77.4	35.4	Tar: pine oil = 1 : 1 (mixture). Half of mixture added before grinding; half after. Results are the average of two tests.
23.0	50	20.0	25	29.6	22.0	0.58	0.24	7	L	84.1	60.9	One drop (about 0.004%) turpentine added for concentrates in addition to tar. Results are the average of three tests.
					Standard							
24.0	45	39.5	25	27.5	15.7	0.72	0.28	Cresol, No. 1	M	83.8	55.6	Cresol used in place of tar; turpentine used for middlings. Results are the average of two tests.
14.0	55	25.0	20	25.8	21.1	0.94	0.41	Cresol, No. 2	N	75.8	36.4	Cresol used in place of tar; turpentine used for middlings. Results are the average of five tests.

Cresols used here are samples of two separate lots.

TABLE 3. EFFECT OF TAR VARIATION, PINE OIL REMAINING CONSTANT

Grams Concentrates	Time, Min.	Grams Middlings	Time, Min.	Copper in Concentrates, %	Copper in Concentrates and Middlings, %	Copper in Middlings and Tailings, %	Copper in Tailings, %	Tar No.	Test	Recovery Concentrate and Middlings, %	Recovery Concentrates, %	Remarks
7.0	15	28.0	15	32.2	19.6	1.15	0.55	3	A1	60.8	20.0	Pine oil (0.025%), tar (0.00%) of ore.
17.0	15	23.0	15	35.4	22.6	0.65	0.25	3	A2	80.0	53.3	Pine oil (0.025%), tar (0.015%) of ore.
29.0	15	24.0	15	30.1	18.5	0.36	0.22	3	A3	86.8	77.2	Pine oil (0.025%), tar (0.030%) of ore.
34.0	15	19.0	15	27.6	18.9	0.30	0.22	3	A4	88.6	83.0	Pine oil (0.025%), tar (0.060%) of ore.
7.0	15	28.0	15	32.2	19.6	1.15	0.55	7	B1	60.8	20.0	Pine oil (0.025%), tar (0.00%) of ore.
10.0	50	30.0	15	22.1	21.5	1.25	0.38	7	B2	76.1	21.9	Pine oil (0.025%), tar (0.015%) of ore.
15.0	50	21.0	15	27.6	23.4	0.88	0.31	7	B3	74.6	36.7	Pine oil (0.025%), tar (0.030%) of ore.
19.0	?	29.0	?	29.9	19.7	0.76	0.25	7	B4	83.7	50.3	Pine oil (0.025%), tar (0.060%) of cre.
5.0	50	12.0	15	15.5	22.0	1.41	1:03	6	C1	27.0	7.5	Pine oil (0.013%), tar (0.015%) of ore.
9.0	50	24.0	15	21.6	23.3	1.25	0.49	6	C2	68.0	18.0	Pine oil (0.013%), tar (0.030%) of ore.
16.0	?	35.0	?	20.7	16.8	1.00	0.30	6	C3	75.8	30.0	Pine oil (0.013%), tar (0.060%) of ore.

TABLE 4. EFFECT OF PINE OIL VARIATION, TAR REMAINING CONSTANT

Grams Concentrates	Time, Min.	Grams Middlings	Time, Min.	Copper in Concentrates, %	Copper in Concentrates and Middlings, %	Copper in Middlings and Tailings, %	Copper in Tailings, %	Tar No.	Test	Recovery Concentrate and Middlings, %	Recovery Concentrates, %	Remarks
11.0	40	18.0	15	21.2	26.6	1.15	0.43	3	D1	68.2	20.7	Tar (0.03%), pine oil (0.00%) of ore.
18.0	25	23.0	15	31.2	22.2	0.66	0.19	3	D2	80.6	49.9	Tar (0.03%), pine oil (0.013%) of ore.
28.0	15	27.0	20	29.9	17.7	0.40	0.22	3	D3	86.1	74.1	Tar (0.03%), pine oil (0.025%) of ore.
35.0	15	24.0	15	26.2	16.7	0.25	0.16	3	D4	87.2	81.1	Tar (0.03%), pine oil (0.050%) of ore.

Mohawk Mining Co.

The Mohawk Mining Co., Mohawk, Mich., for 1914 reports a profit of $432,053 from a production of 11,094,859 lb. of copper sold at 12.47c. per lb. Dividend payments amounted to $100,000, making a total disbursement of $3,275,000 in dividends to date. The company ended the year with a balance of quick assets amounting to $852,208. There were 665,852 tons of rock hoisted and 649,649 tons stamped. The production of concentrates amounted to 14,591,000 lb. The yield of the ore was 17.08 lb. per ton, or 0.854%. The total cost of producing copper was 8.58c. per lb., of which 0.35c. was for con-

struction and strike expense. The following table gives a record of the operations of this company for the last nine years:

Year	Tons Stamped	Yield Lb. Cu.	Total Lb. Copper Produced	Cost per Lb.	Profit	Dividends
1906	618,543	15.12	9,352,252	11.4c.	$763,302	$500,000
1907	640,777	15.77	10,107,266	11.6c.	398,405	900,000
1908	685,823	15.01	10,295,881	10.8c.	276,778	250,000
1909	819,019	13.73	11,248,474	11.2c.	223,691	300,000
1910	802,537	14.22	11,412,066	11.4c.	188,083	200,000
1911	802,548	15.07	12,091,056	10.4c.	269,506	175,000
1912	787,941	15.22	11,995,598	10.6c.	656,435	350,000
1913	366,458	15.76	5,778,235	13.2c.	123,839	500,000
1914	649,649	17.08	11,094,859	8.58c.	432,053	100,000

First Aid at Ray Consolidated

By J. T. More*

In keeping with the nation-wide impetus that is being given to first aid to the injured, the Ray Consolidated Copper Co., at Ray, Ariz., has instituted a regular course of training. This covers a period of six weeks, one lesson a week being given to each class. The course follows very closely that given by the United States Bureau of Mines. The first lesson covers a general discussion of first aid, its aim and scope; the bones of the body, illustrated with a skeleton; the circulation of the blood, arterial and venous bleeding, the location of "pressure points"; the respiratory system; the nerves; the muscles; "dont's" in first aid (under this head the men are impressed with what *not* to do—the rudiments of surgical cleanliness, don't wash or touch wounds); first-aid treatment for shock; the application of the triangular bandage. The second lesson covers strains, sprains and dislocations and the bandaging of breaks without splints, such as the lower jaw, shoulder-blade, collar-bone, ribs and pelvis. In the third lesson the splinting of broken bones is taken up and demonstrated. The fourth lesson is given up to the handling of injured persons; carries with stretchers—army and improvised; carries without stretchers. The fifth lesson covers artificial respiration, and the sixth is a general review. During the whole course the men actually perform first aid on a patient for supposed injuries. Upon finishing this course the men are given the Ray Consolidated Copper Co. diploma and a gold first-aid watch charm engraved with the owner's name.

Challenge Cup Stimulates Interest

The men are encouraged to organize first-aid teams, each to consist of a captain and five men. These teams compete in local contests for the "Ray" cup. This cup is held by the winning team and their names are engraved upon it. At the next contest it is again offered as award and so on until some one team succeeds in winning it three times, when it becomes the property of this team. The interest in these contests runs high and the competition is keen.

The first local contest was held May 5. Four teams entered. G. W. Salisbury, safety inspector of the United Verde Copper Co., Jerome, Ariz., acted as judge. Rules and discounts as outlined by the American Mine Safety Association were followed. No. 1 Team was composed of surface men, mostly machinists; No. 2 Team, miners representing No. 2 mine; No. 3 Team, Mexican miners from No. 3 mine; No. 4 Team, miners from No. 1 mine. The following is a list of the events:

One-Man Event—A man shoots in the face of a drift on going off shift. He is caught by powder smoke from the outside and is overcome. Falls and receives a severe laceration on the head. One man recover, carry 50 ft. and treat condition.

Two-Man Event—A miner is caught by a fall of rock. Two men working with him escape. They go back for the injured man and find that there are still dangerous slabs left in the back. Injuries sustained are as follows: Right ear scraped, right shoulder and right side of chest scraped with long shallow cuts and a simple fracture of the upper third of the right forearm. Two men recover patient and treat condition.

Three-Man Event—A mucker picks into powder in a muck pile in an openpit workings, exploding the powder. Injuries received are as follows: Face and both eyes filled with small rocks; right hand and wrist badly lacerated with severe bleeding; fifth and sixth ribs on the left side broken at the front and the right knee badly wrenched. Three men treat condition.

Team Event—A miner is working in a timbered stope. A rock falls from the back, breaking the flooring he is standing on and letting him drop two sets to a muck pile beneath. Injuries sustained are as follows: A fracture of the third, fourth and fifth ribs on the right side; a compound fracture of the lower third of the right thigh with severe bleeding; scalp wounds and the upper half of the right ear torn loose; small cuts about the right eye and a deep, short cut on the left thigh above the knee with severe bleeding; man unconscious but breathing. Team treat.

Mexican Team at a Disadvantage

The teams were given two minutes in which to discuss the problem at hand. No. 4 Team (R. T. Fees, captain; A. Anderson, D. Rebstock, J. A. McRae, H. C. Penney, E. R. Russell) won the contest with a score of 91.6%; No. 2 Team was a close second, No. 1 Team third and the Mexican Team fourth. There was but one man on the Mexican team with a thorough knowledge of English, and it was necessary for him to translate the problem and carry on the discussion in the two minutes. Under the circumstances this team did excellent work. In view of the fact that none of the teams had practiced more than three months, the showing made was very gratifying.

There were six teams entered in the second contest, held June 18. J. C. Roberts, mining engineer, United States Bureau of Mines, acted as judge. Due to the fact that it was impossible for a person to judge six teams at one time, the following method of procedure was adopted: The six teams were divided into two squads (*A* and *B*) of three teams each, this division being made upon a basis of time spent in practice; but two events were given, a two-man and full team; squad *A* performed first in the presence of squad *B*, then *B* worked a similar event in their presence; squad *B* then performed the full-team event first, squad *A* following with a similar problem; the highest team in the two events in each squad was given an elimination team event to decide the winner of the cup. These events were written in English and Spanish in an effort to overcome the handicap under which the Mexican team had worked in the first contest.

The *A* squad worked the following problem: Two-Man Event—Man caught by fall of rock. Scalp wound on top of head above right ear, severe bleeding. Compound

*Safety inspector, Ray Consolidated Copper Co., Ray, Ariz.

fracture of left forearm, midway between elbow and wrist, accompanied with severe bleeding. Fifth right rib broken, simple fracture. Patient is unconscious but breathing. Treat and carry 50 ft. without stretcher.

The *B* squad followed this with: Two-Man Event—Man caught by fall of rock. Left ear torn nearly off, bleeding. Compound fracture of right arm, midway between shoulder and elbow, severe bleeding. Bones of left hand crushed. Patient unconscious but breathing. Treat and carry 50 ft. without a stretcher.

Event for Full Team—*B* squad: Patient has cut fuse too short and blast occurs while he is going out. Air bad, candle will not burn. Patient is found 20 ft. from face of drift unconscious from bad air, not breathing. Back of head, ears, shoulders and back of arms badly burned. Compound fracture of right thigh just above knee. Treat and carry 50 ft. on stretcher.

Event for Full Team—*A* squad: Patient has cut fuse too short and blast occurs while lighting other shots. He is found near face of drift with the following injuries. Patient unconscious, not breathing. Severe burns on face, neck and arms (in front only). Simple fracture of right thigh, midway between knee and hip. Simple fracture of left leg, midway between knee and ankle. Air is bad in drift, candle will not burn. Treat and carry 50 ft. on stretcher.

Elimination Event—Man falls down 30-ft. winze. In bad air when found, unconscious (not breathing); candles will not burn. Suffers compound fractures of both thighs above knees. Right collar-bone broken. Treat and carry 50 ft. on improvised stretcher.

Close Scores by Leading Teams

The following will show the preliminary scores of the various teams: Squad *A*—Team No. 1 (No. 1 Mine, American), 92.2%; Team No. 2 (No. 2 mine, American), 93.2%; Team No. 3 (Surface), 83.0%. Squad *B*—Team No. 4 (No. 3 Mine Mexican), 89.0%; Team No. 5 (No. 2 Mine Mexican), 80.6%; Team No. 6 (Engineering), 92.4%.

The scores made on the elimination problem were: Squad *A*, Team No. 2 (No. 2 Mine American), 94.0%; Squad *B*, Team No. 6 (Engineering), 91.0%.

It will be noticed that Teams Nos. 1, 2 and 6 had scores almost identical although they did not all work on the same problems. No. 4 Team raised its score from 64.6% to 89.0% in six weeks' time, while No. 5 Team made a score of 80.6% at its first appearance on the field.

The men have shown their skill not only in contest work but also in actual service. By far the great majority of accidents, whether on the surface or underground, are given first-aid treatment before the patient is seen by the doctor. First-aid cabinets are installed in different sections of the mines and in centrally located points on the surface, and the 200-odd men, either wholly or partially trained, have at all times shown great willingness to help.

Costa Rica Now Imposes an Export Duty of 15% ad valorem on all gold bullion of Costa Rican origin. Each gold-mining establishment in the country must make a monthly report of production and must deposit with the Secretary of the Treasury bills of exchange sufficient to cover export duties, against which such duties will be charged. No exportation will be allowed until satisfactory deposits have been made.

Kowkash Gold District*

Kowkash station is 297 mi. west of Cochrane, Ont., on the National Transcontinental Ry. The recent gold discovery lies 9 mi. northwesterly from Kowkash station, near Howard Falls, on the Kawa-kash-kagama River.

The country is of low relief and consists of rocky hills up to 100 ft. or more in height, separated by large swamps, semi-muskegs and sand and gravel areas. The rocky hills are covered with a dense growth of small timber and moss and sometimes large loose boulders, which make prospecting somewhat difficult. The height of land at Redmond, 15 mi. west of Kowkash station, has an elevation of 1,122 ft. This northwest-and-southeast divide separates the waters of the Great Lakes from those of Hudson Bay.

History and Early Exploration of the Region

The gold discovery occurs on the river which the Indians call Kawa-kash-kagama, which signifies sparkling water. This name has been shortened to Kawashkagama by the Geographic Board. The National Transcontinental Ry. has further shortened the word by naming the station Kowkash, which the propectors have likewise done to the name of the river—hence the name of the new gold area.

The part of the Kowkash River near the gold find was examined by Dr. R. Bell and is described in the annual report of the Geological Survey of Canada for 1870-1; also by party No. 5 in a report entitled "Exploration of Northern Ontario," issued by the Ontario Department of Crown Lands, 1900, p. 156. In this report E. V. Neelands, geologist with party No. 5, blazed the way for the prospector when he stated "Huronian rocks, mainly chlorite and other soft green schists, occur on the Kawa-kash-kagama (Kowkash) River from about 4 mi. below the Wawong portage to the northern limit of exploration (Howard Falls). The most promising district is the country on the Kawa-kash-kagama River below the Wawong portage. Here Huronian exposures are numerous, mostly chlorite and other soft green schists. Several samples from small quartz veins in this district showed traces of gold, and it might be that careful prospecting in this district would be rewarded." W. J. Wilson and W. H. Collins' map, No. 964, published by the Geological Survey, Ottawa, which roughly outlines this Kowkash Keewatin area, is being much used by the prospectors at the present time.

E. W. King Dodds made his spectacular gold discovery on Aug. 21, 1915, when walking over the rocky hill below Howard Falls, which had been burned clean of moss and trees on the previous day. The news of the spectacular ore caused a rush of about 400 prospectors to the neighborhood, and about 75 to 100 claims were staked within three weeks.

General Geology of the Region

In the Kowkash area is a belt of Keewatin rocks 10 to 15 mi. wide and extending from the north end of O'Sullivan (or Sesekenaga) Lake in a southwest direction through Howard Falls and across the height of land at Redmond. This whole Keewatin area is worth prospecting for gold. For miles around this Keewatin belt are Laurentian granite and gneiss rocks.

*Abstract from a report by Percy Hopkins, Assistant Provincial Geologist of Ontario.

The Keewatin formation is largely massive, composed of fine-grained green chlorite and hornblende rocks, which are in places altered to schist. Some of the chlorite rock is altered diabase. Numerous exposures can be seen along the Kowkash River from 3 mi. below where Johnson Creek enters the Kowkash to within a mile of the drift-wood portage. Altered basalts showing the pillow or ellipsoidal structure are common. They are well exposed from Howard Falls to beyond the Dodds gold showing, on the portage below Howard Falls and around O'Sullivan Lake. With the basalts are small agglomerate areas. Cutting these greenstones are numerous white-weathering quartz-porphyry dikes up to 30 ft. or more in width. They contain in a gray to green fine ground mass numerous white-quartz phenocrysts the size of peas.

Porphyry Resembles Porcupine Quartz Porphyry

The porphyry contains some quartz stringers, is schistose in places and resembles the quartz porphyry at Porcupine, Goodfish Lake and north of Schreiber. The main exposures seen extended for a mile eastward from Howard Falls and around O'Sullivan Lake. About 2 mi. below Howard Falls and one chain from the left bank is a large hill which has been recently burned. The south fringe of the exposure is a slate and conglomerate similar to the Timiskaming sediments in Porcupine, Kirkland Lake and Munro Township. The sedimentaries dip vertically and strike 25° north of east. The slate is very cherty. The pebbles of the conglomerate are drawn out and consist of chert, quartz porphyry, amygdaloidal basalt and gneiss. North of the sedimentaries is a large volume of massive pillow lava. Around the center portage between Abamasagi and O'Sullivan Lakes is a fine slate-like biotite and chlorite schist striking 35° east of north and dipping from 50 to 80° southeastward. This may be of sedimentary origin. At the last portage into O'Sullivan Lake is an actinolite rock, below which are numerous massive serpentine exposures. A gabbro and diabase, probably the youngest rock in the area, occurs about 300 yd. north of the Dodds gold find. Dikes a foot in width also cut the basalt on the Dodds claim. The direction of ice movement was 35 to 40° west of south.

Description of King Dodds' Discovery

Dodds' gold quartz vein, which is the only reported discovery up to the present, is ⅝ mi. below Howard Falls and 800 ft. north of the river. The vein strikes 8° south of east and appears to dip 75 or 80° to the north, thus conforming in strike and dip with the country rock. The vein, which is somewhat lenticular, is up to 4 or 5 in. in width and can be traced about 40 ft., ending in drift on either end. The quartz is glassy and largely free from sulphides. Spectacular gold was seen in place over an area about 5 in. long and 1 in. wide. This showing extended 5 in. along the hanging-wall side of the vein. Similar and richer specimens were reported to have been taken from the 4 or 5 ft. adjacent to the showing. On the hanging-wall side of the vein is a rusty schist band 6 in. wide and heavily mineralized with fine pyrite. The wall rock is pillow lava (basalt), which is altered to schist in places. A mineralized quartz-porphyry dike occurs about a chain southeast of the gold showing.

All the information on the area is being compiled by the Ontario Bureau of Mines, and a map will be published.

Engineering Congress Meetings in San Francisco

Editorial Correspondence

The mining industry is still the chief attraction in San Francisco and at the Panama-Pacific Exposition. The American Institute of Mining Engineers concluded its technical sessions on Sept. 18, and on Saturday visits were made to the deep gold mines at Grass Valley, the gold dredges at Oroville, the oil fields at Coalinga, with a yacht cruise on San Francisco Bay and a visit to the Selby smeltery. On Sept. 20 the American Mining Congress began its 18th annual session at the Civic Auditorium, closing on Sept. 22. The International Engineering Congress also met on Sept. 20, concluding on Sept. 25. The California Metal Producers' Association held its initial field meet for demonstration of first aid as taught by the Bureau of Mines, on Sept. 22. This will be the initial annual meet of California teams under the auspices of the Metal Producers' Association.

The third annual joint field meet of first-aid and mine-rescue teams under the auspices of the Bureau of Mines began on Sept. 23 and concluded on Sept. 24. During the two weeks there have been in attendance at the conventions and the demonstrations at the exposition a large number of mining men engaged in the various branches of the industry, from all parts of the United States and some foreign countries. Probably the number of mining men in San Francisco and visiting the exposition within this period is larger than has been assembled at any other point for a number of years.

Mineral Resources of Hunan

A report from United States Consul N. T. Johnson at Chingsha, China, after referring to the antimony mines of Hunan and stating that this business is again on a competitive basis, says that lead and zinc are being mined in the mountains near Sung Peh, on the Siang River, about 30 mi. south of Hengchow. A 3-mi. narrow-gage railway is used to carry the ore down to the river. The machinery is mainly of German origin, and it is understood that Carlowitz & Co. have invested about 600,000 taels in the mine and that they take most of its output. In the dressing plant 2,000 coolies are employed. Some of the mining is done in the old Chinese way; however, they are working four modern shafts, one being about 800 ft. deep. The mines, employing probably 5,000 men, are entirely under the management of two Cantonese, both trained in the coal mines at Ping Hsiang.

Saltpeter is found in Yung Hsunfu, Lung Shan, Sang Chih Shihmen and Tzu Li. Large quantities of firecrackers are manufactured in the neighborhoods of Siangtan, Changsha and Changteh, thereby creating a demand for this chemical.

Coal is found in the valley of the Siang and in the western part of the province about Shenchow and Yuanchow. That from the Tzu River, in the district about Paoking, finds its way down the river through Tungting Lake to Hankow.

Deposits of iron are worked by the natives at Chin-chou, near the southern border of the province. The mineral wealth of Hunan is just being tapped, and its possibilities are almost without limit.

American Institute of Metals

EDITORIAL CORRESPONDENCE

Among the interesting papers presented at the meeting of the American Institute of Metals, Atlantic City, on Sept. 29, was one treating of "The Effect of the Present European War on the Metal Industry," by T. F. Wettstein, of the United Lead Co., New York. In the discussion of this paper it was brought out that under normal conditions this country supplies its own demand of zinc, but leaves nothing much for export. The destruction of the Belgian and Silesian zinc industries then leaves a total of about 150,000 tons of the normal demand to be supplied for foreign nations. At the present time, because of its use in war, the demand for zinc is 10 times the normal amount. It was also brought out that the common grades of the metal have increased much more, comparatively, in price than the high-grade material. The premium on high-grade is normally up to about 40%, whereas at the present it is not over 30%. Some common grades of zinc are redistilled in order to secure a high-grade product, but redistillation does not affect the cadmium, which remains in the product. Cadmium runs up to 0.2, 0.3 and 0.4% in the redistilled material. The element is objectionable because it interferes with its utilization for many purposes.

A paper presented by Dr. S. Trood, of the United States Sherardizing Co., New Castle, Penn., on sherardizing methods, was one of wide interest, in that he described the necessity for the presence in the zinc thus used of a certain percentage of zinc oxide, not less than 8%, according to Doctor Trood; the service of the zinc oxide being to protect the zinc from melting and becoming a liquid and unmanageable mass under the required heat. Doctor Trood showed the possibility, owing to the presence of this oxide, of the passage of zinc from the solid to the gaseous state without passing through the liquid form. It was shown also that the continued re-use of zinc for sherardizing involved the accumulation in it of particles of iron, and these would rust upon exposure of the article to the air, forming an unsightly coating, although the protection to the iron of the article itself was no way impaired.

Papers on "Electric Furnace for Brass Melting" and "Substitutes and Alloys to Take the Place of Platinum" were not presented, and a paper on the "Alloys of Nickel, Chromium and Copper," by D. F. McFarland and O. E. Harder, of the University of Illinois, was read.

At the afternoon meeting an interesting paper on aluminum die casting was read by Charles Pack, of the Doehler Die Casting Co., Brooklyn, N. Y. The process of die casting was described, and the wearing effect upon the dies (for which a suitable metal is being sought) was discussed in detail. There was then read a paper upon the Manufacture and Use of Alumino-Vanadium, by William W. Clark, of the Seymour Manufacturing Co., Seymour, Conn.

D. V. Pannell, of the British Aluminium Co., Toronto, Ont., read a paper on "Recent Advances in the Manufacture and Uses of Aluminum." This process described the mechanical handling and working of aluminum, both as to drawing into wires and its use for other articles of commerce. In addition Mr. Pannell gave a thorough account of the requirements for welding aluminum, a process which is being practiced successfully by his company. A paper on "Aluminum-Bronze Alloys" was then read by W. M. Corse, of the Titanium Alloy Manufacturing Co., Niagara Falls, N. Y.

The papers listed for the Thursday meetings were as follows: "Development of an Acid-Resisting Alloy," by S. W. Parr, University of Illinois, Urbana, Ill.; "Methods of Analysis for Complex Alloys," by S. W. Parr, University of Illinois, Urbana, Ill.; "Effect of Zinc on Copper-Tin-Lead Alloys," by G. H. Clamer, Ajax Metal Co., Philadelphia; "The Advantages of a Standard Railway Journal," by Russell R. Clark, Pennsylvania R.R., Pittsburgh, Penn.; "Forging Manganese Bronze," by Jesse L. Jones, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn.; "The Failure of Structural Bronzes," by Dr. P. D. Merica, Bureau of Standards, Washington, D. C.; "Experiences with Brass in Civil Engineering Work," by A. D. Flinn, Board of Water Supply, New York; "Stellite," by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

Composition of Graywacke

Graywacke is a general term used in the field to designate certain obscurely bedded, in places much-altered, greenish rock, which ranges in texture from distinctly conglomeratic to aphanitic. Some of the finer-grained graywackes can with difficulty be distinguished from igneous rock. The result of field study led to the inference that the graywackes consist largely of igneous material worked over mechanically, but not greatly decomposed before deposition, and this inference is confirmed by microscopic study. Since their deposition, however, they have been in places greatly changed by shearing, brecciation and the development of secondary minerals. The degree of metamorphism necessary to convert a certain rock into a graywacke has not been determined or defined.

The United States Geological Survey[1] gives the following description of conglomeratic specimens of graywacke examined by it: The broken surface of the rock of one specimen, with the appearance of augite lamprophyre, showed bedding and pebbles. The slide showed the graywacke pebble to consist of fragments of augite, hornblende and feldspar in a dusty chloritic matrix. In some specimens the matrix is too fine-grained for determination. The material as a whole seems to be like that of broken-down, but not greatly altered, porphyry.

Another specimen, resembling basalt in appearance, was found to contain minute prisms of hornblende in a much finer-grained matrix; secondary hornblende and epidote were also found. Another specimen was described as dark greenish-gray, mottled with dark red, having a brecciated appearance. The microscope showed that the red patches were fragments of acid porphyries in which phenocrysts of feldspar were contained in a ground mass almost entirely calcite and chlorite. The matrix of the graywacke consisted of fragments of feldspar cemented by calcite and chlorite. Another specimen was a dark greenish rock, the only distinguishable structure being an irregular cleavage of hornblende and light aphanitic rounded or subangular patches. A weathered surface of this rock was light colored and chalky, with distinct fine-grained patches. Epidote and magnetite were abundant.

[1]Professional Paper 87, "Geology and Ore Deposits of Copper Mountain and Kasaan Peninsula, Alaska," 1915.

Details of Practical Mining

Shaft-Sinking with Jackhamers

By Leroy A. Palmer*

At the Black Oak mine in the "Soulsbyville granite" near the Mother Lode, jackhamers have replaced piston machines in shaft-sinking with a reduction of costs, air consumption, etc. Delay-action exploders have also been of assistance in sinking this shaft.

To the miner of the Mother Lode and the adjacent districts "Soulsbyville granite" conveys a meaning that cannot be amplified by a wordy description. Many of them know it from experience and all by reputation. It is the name given to the rock in the vicinity of Soulsbyville, Tuolumne Co., Calif., in what is known as the "East Belt," lying a few miles to the east of the Mother Lode proper. This rock is a typical gray granite, shading into grano-diorite and containing intrusions of diorite. It is extremely hard.

The Black Oak mine is situated a mile from Soulsbyville in this granite area and is operated through a shaft which has just reached the 1900 level, work on sinking the sump being now in progress.

The shaft was carried to the 1600 level with piston machines; then it was decided to try jackhamers. Inasmuch as a careful comparison of the work of the piston machines in sinking from the 1500 to the 1600 with that of the jackhamers in sinking from the 1600 to the 1700 was in favor of the latter, the work was continued with the lighter machines. The piston drill was a standard type of 3-in. machine.

Four men were used on a shift in each case—in the one, on two piston machines, and in the other, each with a jackhamer—and it was found that the daily progress was increased approximately 25% by using the jackhamers. No attempt has been made to formulate a comparison of the air used but it is known that the four jackhamers consume less than the two piston machines.

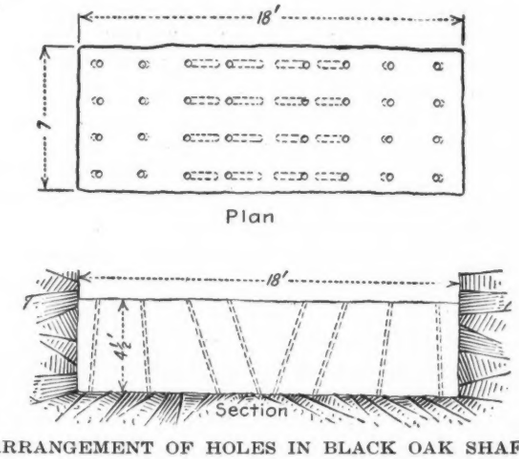
The shaft consists of two compartments and a manway, being 7x18 ft. overall and 5x15 ft. in the clear. It is on a very steep incline which averages from 65 to 70 deg. An ideal round, drilled to break 4½ ft., is shown in the illustration. It consists of 32 holes, two sets of cut-holes, eight to a set, and two sets of side rounds of the same number. The procedure is to put in the inner cut-holes, blast them and muck out before drilling the rest of the round. The outer cut-holes and the side rounds are then put down and if there is time, as is usually the case, another set of shallow cut-holes is drilled in the sump formed by shooting the first series of cuts. It has been found that this system of breaking the cut, then deepening the cut and shooting with the remainder of the round, has increased the progress of sinking about half a foot per round.

Drilling and mucking of the inner cut-holes is all done on one shift by four men. The next two shifts are given over to the muckers who clean out the shaft and get it ready for the drillers. The mucking shifts consist of two muckers and an engineer for the donkey hoist on each shift.

Of course the placing of the holes is varied to suit conditions as they are found in the shaft and it sometimes happens that as many as 25 holes are put down for the side rounds but the illustration shows a typical round. In all of the holes 60% dynamite is used.

The present arrangement of doing all drilling on one shift and mucking on the other two has been very satisfactory. It calls for a total of 10 men including an engineer on each of the two mucking shifts to hoist the broken rock from the bottom of the shaft to the 1600, where it is used for filling. The same headway has been made thereby as previously when there were four miners on each shift, drilling or mucking as occasion required.

The men are paid on a bonus system. The regular wages are $3.75 per day to one of the miners who acts as shaft foreman, $3.50 to each of the other miners and the engineers, and $2.75 to the muckers. The miners each receive 25c. a day bonus for every month in which the shaft is sunk over 60 ft. and the muckers the same allowance for every day that they get the shaft cleaned out on time for the drillers to go to work.



ARRANGEMENT OF HOLES IN BLACK OAK SHAFT

During March, 1915, the shaft was sunk under the old arrangement of shifts, four miners on each shift drilling or mucking as the case might be. During this month the cost of sinking was $35.56 per ft. In April the shifts were rearranged, as noted, so that all drilling was done by miners on one shift and the shaft cleaned out by muckers on the following two shifts. For the first week under this arrangement of shifts the costs were brought down to $27.00 per ft. These are what the management refers to as "direct costs"; that is, cost directly chargeable to the shaft. They include timbering and hoisting from the 1900 to the 1600, but tramming on the 1600 is charged to stope filling. In view of the size of the shaft and the extremely hard rock in which it is sunk they can only be regarded as favorable.

*Mining engineer, 512 Custom House, San Francisco.

Several records have been kept of the progress in drilling with these machines. All measurements were taken during the regular progress of shaft-sinking and with one man doing all of the work in connection with his machine; in other words no attempt was being made to establish a record. Measurements taken in a very hard rib of grano-diorite in the south end of the shaft showed a drilling speed of from 1.09 to 2.13 in. per min. on holes from 2½ to 5 ft. in depth and at all angles from flat to nearly vertical; an average for four holes was 1.64 in. per min. Allowing 32 holes to a round, which is to break 4½ ft., it will be seen that with four machines there is ample time for shooting the center cut, mucking out, drilling the side rounds and shallow cut-holes. In this connection it should be borne in mind that the actual percentage of drilling time is greater with a machine of this type than with a heavier machine.

Of course it is understood that the efficiency of the jackhamer is not due to superior drilling speed but to the ease with which it is handled. Careful records made at the Buckeye-Belmont mine at Tonopah showed that the actual drilling time in sinking the shaft with piston machines was only 160 min. per 8-hr. shift. The men wasted no time but they spent two-thirds of the shift in getting ready to drill and then in getting ready to shoot. A certain percentage of this loss, such as connecting ventilating pipe, changing steel, loading, etc., will be practically constant under any conditions. But it will be found that the greater portion of the loss is chargeable to setting up, tearing down and shifting the machine from one set-up to another. All of this loss is avoided with the jackhamer, which weighs only 40 lb.; and when the shift is ready to shoot, each man simply takes his machine into the bucket with him and the whole lot is hoisted away.

At the Black Oak shaft, ventilation is accomplished by an 8-in. Sturtevant fan on the 1600 level and compressed air at 85 to 95 lb. by an Ingersoll-Rand two-stage compressor, 11x9-16 in., belted to a 150-hp. motor. Considerable water is found in the upper levels but the shaft is dry.

The Black Oak has also used the jackhamers to some extent for drifting. They were mounted on the shell of an old machine on a vertical bar. Two of them, with one man to each, made better progress with less air than two men with one 3-in. piston machine. Detailed records of these trials were not kept.

In connection with this shaft it is well to mention the use of delay-action exploders, to which the management is inclined to give much credit for the progress made, inasmuch as they have facilitated the firing of the shots. The "Ideal" delay-action exploder consists of a detonator, a time-fuse—whose length is chosen to suit the position of the hole—and an electric fuse-spitter to which is connected two copper wires. The detonator is placed in the cartridge in the usual manner and the copper wires attached to the fuses are connected in series, each end of the series being run to a wooden plug in a shallow hole at one end of the shaft. At these plugs connections are made with the two ends of an electric-light line brought down the shaft for this purpose. The exploder switch is in a locked box on the 1600 level, the key to the box being in the possession of the shaft foreman. There are no openings in the box for the wires leading down the shaft, so the door must be unlocked and opened before the wires are connected to their binding posts, and likewise they must be disconnected before the door can be closed. As a further precaution the switch is so arranged that the door cannot be closed unless the switch is open.

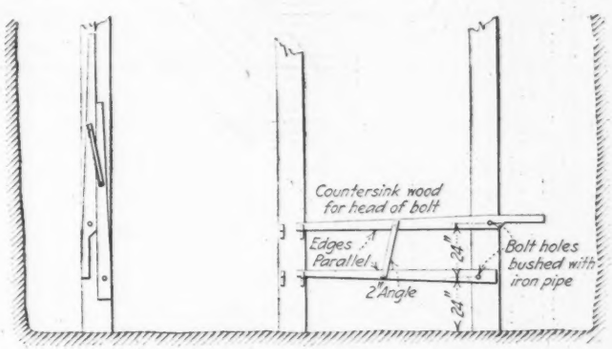
Thus the shaft men, after loading their holes and making the connections to the light line through the plugs, may leave the shaft leisurely. When the 1600 level is reached the shaft foreman goes to the switch box, opens it, connects the light-line wires to their binding posts and fires the round by closing the switch. Before he can close the door he must open the switch and disconnect the wires. Missed holes by this method are extremely rare; and it is certainly an improvement over spitting a round of holes with a candle or acetylene lamp, with the smoke so thick that one can hardly see, and then scrambling hurriedly into the bucket or up the ladder to reach a point of safety.

The writer acknowledges the courtesy of Roger Knox, superintendent, and J. H. Tate, engineer, of the Black Oak Mining and Development Co., in assisting in the collection of these notes.

Simple Folding Shaft Gate

By Frederick T. Teddy*

The simple shaft gate shown herewith has been in use for some time at the mines of the Tennessee Copper Co., Ducktown, Tenn., It has proved effective, as well as inexpensive in construction and maintenance. I suggested



A SIMPLE FORM OF SHAFT GATE

this gate as eliminating the undesirable features found in the usual gates that swing horizontally and others with counterweights that give more or less trouble.

The essential parts of this gate consist of two wooden rails and a short length of angle iron. The rails should be of hardwood, of 2x6-in. section, dressed on all sides and tapered to 3-in., one of the rails being longer, to provide a handle with which to raise the gate.

The gate is supported or hinged by means of lagscrews or bolts, and the bearing holes should be bushed with iron pipe. The diagonal tie iron should be a 2-in. angle section, and the spacing of the bolt holes in it must be the same as the straight-line distance between the supporting lagscrews. The corresponding holes in the bars must measure the same from the bushed bearings.

In erecting the gate it is preferable first to determine the position of the lagscrew or bolt for the top rail, and

*Mining engineer, Box 143, Ducktown, Tenn.

to swing the gate on it to the up position, bringing the lower bar parallel with the upper one, letting them incline backward a little. This fixes the position of the lower supporting screw. The gate may now be lowered and the brackets set in place.

Chart of Relative Values of Fuels*

In estimating the relative steaming values of fuels of different calorific values consideration must be given to the boiler and furnace efficiencies attainable. In any instance the equivalent evaporation in pounds of water evaporated from and at 212 deg. F. per pound of coal would be

B.t.u. per pound of fuel × per cent. of efficiency ÷ latent heat of steam at 212 deg. F.

The chart herewith has been prepared to save tedious calculations. Slanting straight lines represent the calorific value of fuel in thousands of B.t.u. per pound, each line being so drawn as to pass through points whose ordinates represent boiler and furnace efficiencies and whose abscissas represent the equivalent evaporation from and at 212 deg. F. per pound of coal.

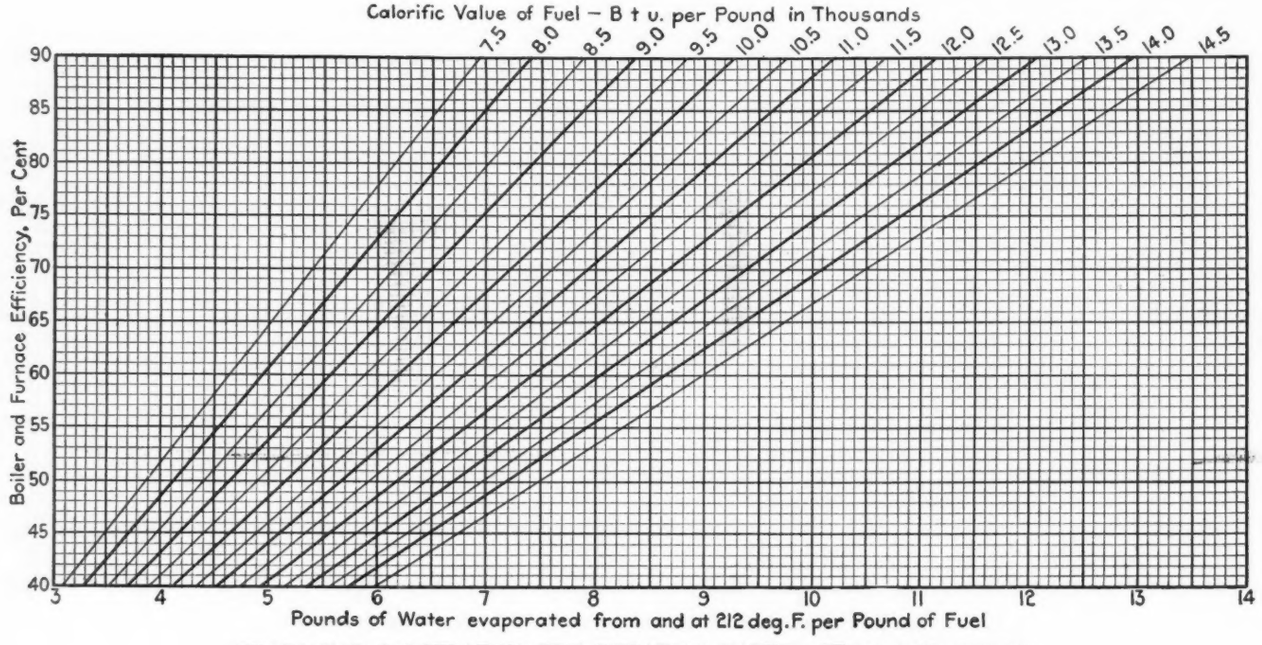


CHART FOR CALCULATING THE RELATIVE VALUES OF VARIOUS FUELS

To read the chart, start at the left-hand side at a given percentage of efficiency, as 70, and following along horizontally to the intersection with the inclined line representing the thousands of B.t.u. per pound of fuel, as 14, and then follow vertically downward to find the value 10.1 pounds of water evaporated from and at 212 deg. F. per pound of the coal, which for most practical purposes would serve the same purpose as the arithmetical solution,

$$\frac{14{,}000 + 0.70}{970.4} = 10.098$$

*By Richard A. Rover, in "Power" of Sept. 28, 1915.

Fuse Spitting with a Match

The following method of lighting a single black-powder time fuse is suggested by the United States Bureau of Mines as being more efficient than the old method of splitting the end of the fuse. The method is adopted when only one piece is to be lighted. It is not applicable when several pieces are to be lighted, as the time interval between ignitions would be too long.

A safety match is held against the powder core at the end of the fuse and the matchbox drawn across the match, causing the match and powder core to inflame immediately. It will be noted that this is just the reverse of the usual way of lighting a match—drawing the match across the box.

In case safety matches are not at hand, the ordinary household match can be used by placing one match against the powder core and then lighting another and quickly touching it to the first one.

It is believed that the method outlined, originated by W. C. Cope, of the explosives chemical laboratory of the bureau in Pittsburgh, as the result of experience obtained in the igniting of hundreds of pieces of black-powder fuse, will be helpful in quarrying and other outside work. It has the advantage of cheapness, as no fuse lighters are required.

Mullan Hand-Drilling Contest

The results of the double-hand drilling contest held at Mullan, Idaho, on Labor Day, were as follows:

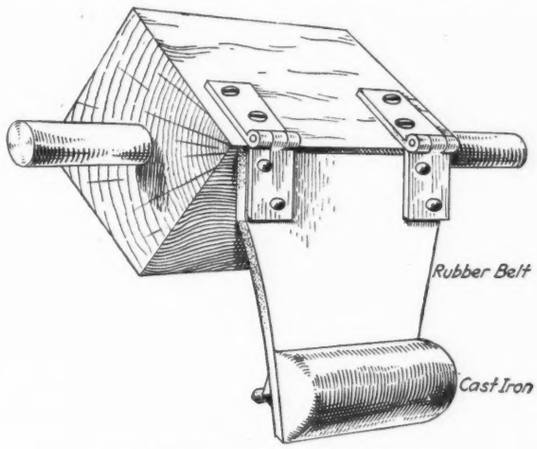
First place, Leaf and Kinsella, of the Tamarack-Custer mine, 30⅝ in.; second place, St. Germain and Stokes, of the Osborne, 28⅛ in.; third place, Haff and Rosseman, of the Stewart mine, 27⅛ in.

The rock drilled in is granite. The first prize was $200. There are said to have been about 5,000 people in Mullan for the celebration.

Details of Milling and Smelting

A Simple Conveyor-Belt Cleaner

When ores are wet or when they are of a sticky, tenacious nature, they are likely to cause considerable annoyance by their tendency to cling to conveyor belts, refusing to be discharged at the proper point, but riding around on the belt in a continuous performance. A good many schemes have been tried in attempting to counteract this tendency—that is, to remove the ore from the belt as it passes the discharging point—but most of them have failed for one reason or another. Wire brushes have been tried, but they have a tendency to clog up and also to cut and destroy the conveyor belt. Scrapers are also dangerous, since they may occasionally catch in a small snag in the belt and are likely to ruin it utterly. At the Gold Hunter mill, near Mullan, Idaho, a contrivance has been devised, however, which seems to have been entirely successful.



THE CONVEYOR-BELT CLEANER

The appliance consists of a square wooden block with a hole through it, the block being mounted on a shaft and acting like a pulley. Fastened to one of the corners is a strap hinge with its free end bolted to a piece of rubber belt at the end of which is fastened a small half-circular iron casting. The idea is that this pulley revolves fast enough to keep the belt standing out from the pulley far enough to strike the conveyor belt at every revolution. The round casting face hits the conveyor belt a sharp rap, jarring loose whatever ore or clay may be sticking to it. Owing to the presence of the hinge, after striking the conveyor belt the piece of belting with its attached casting falls back against the square face of a pulley, avoiding all dragging or rubbing on the conveyor. Since the blow struck the belt is sharp and sudden and does not drag or wipe the belt, no damage results to it and there seems to be no objection whatever to its use. The appliance is mounted over the ore bin into which the conveyor belt discharges, thus insuring that all of the ore is delivered at the proper point.

Rotary Kilns for Desulphurizing and Agglomerating

Rotary kilns have been used for the preparation of iron ores for blast furnaces for a decade or more, but during the last few years they have been introduced also into copper metallurgy. The design and application of such kilns for the desulphurization and agglomeration of iron ores are discussed[1] by Samuel E. Doak, and while his remarks apply mainly to the treatment of pyrites cinder and other fine iron ores, they nevertheless contain a record of practice that might profitably be considered by the copper metallurgists.

In the case of lump or fine iron ores carrying not to exceed from 6 to 7% of sulphur, the desulphurization can be combined with agglomeration, provided the kiln is sufficiently large. The process is a simple roasting, with the addition, in the case of fine ores, of a nodulizing or agglomerating operation, performed near the discharge end of the kiln, at a higher temperature than is necessary for the desulphurization. If the kiln is not forced beyond its capacity, there is no difficulty in reducing the sulphur to less than 0.5% in the finished product. (In modern practice the sulphur content of the pyrites cinder is rarely as great as 6, and seldom lower than 1½%.)

As far as the desulphurizing action is concerned, the principal caution to be observed is not to allow the kiln to get too hot at the back end. To get a dead roast, the operation should be gradual and the heat should range from a barely perceptible dull red at the feed end to a bright yellow at the discharge end. When the ore is too hot in the center of the kiln, there seems to be a tendency to hinder desulphurization, probably on account of an almost imperceptible glazing of the particles, that renders them impervious.

For this reason it is important that the roasting should be complete before the nodulizing begins, since for the success of the latter the ore should be sufficiently pasty to ball up. This pastiness, however, should never be carried to a point where there is any flow of the cinder, and in fact should never be visible in the kiln. A bright-yellow heat is sufficient for the nodulizing, and it is well to keep the zone of agglomeration as near the discharge end of the kiln as possible, 15 ft. being sufficient length for the operation in any kiln not over 100 ft. long. For this reason a short flame is desirable. At present the rotary kiln owes what popularity it possesses to its nodulizing feature, in spite of the fact that it is a cheap and efficient roaster, and that it is much more successful as a roaster working on coarse than on fine ore.

The one great obstacle now in the way of continuous operation of rotary kilns, is the formation of rings caused by the cinder becoming hard enough to stick to the lining. The ring usually forms in the 15 or 20 ft. nearest the discharge end of the kiln and puts an

[1] "Bulletin of A. I. M. E.," September, 1915.

excessive amount of weight upon that end. Many devices have been tried to prevent the formation of the ring or to remove it without stopping the kiln, but none of them has been thoroughly successful. The best plan, according to Mr. Doak, is to shut down the kiln when the ring becomes too large, cool it off with water, and cut it out with bars and picks. The formation of the ring can be postponed by keeping the conditions of temperature, speed and feed from fluctuating. [Chains dragging in the kiln have also been used to prevent the formation of the ring.—EDITOR.]

Mechanical difficulties, so common when rotary kilns were first used for the treatment of iron ores, have been practically eliminated. The most important points to be observed to insure continuous operation are to make the kiln sufficiently strong (reinforcing it especially under the tires) and to keep the operating machinery well protected from dust. The tires should always be kept tight to the shell, since, if any play is allowed, the bolt holes will gradually become enlarged and the kiln will bear down hill so strongly that it will frequently break its thrust bearings. At least 1 in. of additional metal should be put around the shell under the tire. With the larger kilns, a 9-in. firebrick lining is used, while for kilns of 5 or 6 ft. diameter a 4½-in. brick is satisfactory.

The size and shape of the ore particles, the depth of bed, condition of lining and size of the kiln—all have an effect upon the speed or progression of the charge in the kiln. Any type of cinder can be treated satisfactorily in kilns from 80 to 100 ft. in length, turning at a speed of from 1 revolution in 60 sec. to 1 in 90. The greater length is safer in treating all fine high-sulphur cinders, since it greatly reduces the chances of a poor product through careless supervision.

CAPACITIES UNDER DIFFERENT CONDITIONS

The tonnage output of a kiln varies greatly with the kind of cinder charged. A kiln 60x5 ft. with 4½-in. lining will treat 1,500 tons a month of low-sulphur lump ore, while on high-sulphur fine it will with difficulty take care of 750 tons. A kiln 85x7 ft. will handle 3,000 tons of high-grade cinder per month and 1,500 tons of the poorest grade, while a kiln 100x8 ft. will treat from 4,500 to 2,500 tons, depending on the quality of cinder. A kiln 85x8 ft. could handle almost as much as the 100-ft. kiln, but at a greater fuel cost. In general the larger kiln will have the lower fuel cost, and the fine domestic ores will need less coal on account of their higher sulphur content. In a 60x5-ft. kiln the fuel consumption averaged for several months about 12% by weight of the roasted ore.

It has been the custom arbitrarily to connect a certain diameter with a certain length of kiln. A 60-ft. kiln is usually 5 ft. in diameter; 80- and 85-ft. kilns are 6 or 7 ft. in diameter, and a 100-ft. kiln is ordinarily 8 ft. in diameter; but it would frequently be more economical to proportion the kiln in a less haphazard way than by accepting the builder's standard design. The two determining factors should be the output desired and the quality of ore to be roasted. The output is dependent upon the dimensions of a cross section of the bed of ore that can be carried in the kiln, the speed of revolution and the slope of the kiln. The slope of the kiln can be left out of consideration, however, as good practice places it at ¾ in. per ft. Increased or decreased output can better be obtained by changing either of the other variables than by changing the slope of the kiln. Speed control is now a feature of the design of every kiln, so that this factor may be adjusted to the most satisfactory point after the kiln is in operation.

The question of output, then, so far as the kiln design is concerned, is determined by the width and depth of the ore bed. In general the latter can be increased with the length of the kiln, since the length of time it takes the ore to pass through the kiln will be greater as the kiln is longer, all other things being equal; but the increased capacity due to length will not be great, since without changing the diameter the ore bed cannot be increased to any considerable extent without harming the roasting process, for which a continual and complete stirring and overturning of the ore bed are necessary. Too great a depth of ore bed prevents this. It seems most reasonable to base the length of the kiln entirely upon the time necessary for desulphurization and agglomeration, and to control the output by the diameter.

OPERATING COST LARGELY RESULT OF LAYOUT

The cost of producing a ton of roasted ore, aside from the cost of the raw cinder, depends chiefly on labor. Two men on a shift should be able to take care of a well designed plant producing up to 100 tons in 24 hr., while in a poorly designed plant this number might easily reach 4 or 5. On a small kiln, 60x5 ft., the labor cost per ton on high-sulphur fine cinder averaged 40c. for several months, and with the same kiln using high-grade lump cinder this figure was reduced to 30c.; both figures, however, were excessive, not only on account of faulty design that made necessary 3 or 4 men on a shift, but also on account of a low output per man, because of the small size of the kiln. Repairs and supplies should not cost over 8c. per ton of roasted ore. The cost of operation of a rotary kiln will be determined almost entirely by the layout of the plant.

*

Hybinette Leaching Process for Copper Ores

In a recent patent (U. S. No. 1,122,759) covering the leaching of copper ores, N. V. Hybinette, of Christiania, Norway, states that sulphide copper is readily soluble in solutions containing 15 grams of ferric iron per liter, while it is insoluble in solutions containing under 10 grams per liter. At 15 or even 20 grams per liter the ferric compounds do not interfere so seriously as to necessitate using tanks with diaphragms. Mr. Hybinette, therefore, roasts the ore so that about 25% of the total copper is present as sulphide compounds insoluble in 5% HNO_3. A solution containing about 30 grams of total iron and 30 grams of copper as sulphates and about 60 grams of free sulphuric acid is provided. This solution continually circulates between the electrolytic cells and the leaching tanks. The cells are provided with lead anodes, but have no diaphragms. So long as the inflowing solution carries about 30 grams of copper per liter and the effluent about 20 grams, the ferric iron will be present in the proper amount. A portion of the solution is periodically withdrawn, completely precipitated, and discarded, so that the total iron may never rise above 35 grams per liter.

Company Reports

El Oro Mining and Railway Co., Ltd.

The directors of El Oro Mining and Railway Co., Ltd., report under date of July 21, 1915, that no accounts have been received from the mine for a long period, so that it is impossible to give the usual statement of the net realized profit for the year ended June 30. Owing to repeated occupation and evacuation of the town of El Oro, accompanied with more or less plundering each time, on Feb. 27 out of the normal population of 25,000 Mexicans, less than 100 remained. Consequently it was with difficulty that enough men were obtained to keep the mine pumps in operation. This, however, has been done, and the directors are advised that enough men have been available to keep the mine unwatered, to continue sinking the deep ventilating shaft and to maintain the various levels of the mine in good condition.

They are also informed that notwithstanding all disturbances no serious loss has been sustained and no material damage done to the mine and reduction works. On the other hand, the rolling stock of the railway has suffered somewhat and some looting has taken place among the houses of the company's staff, though this has not reached serious proportions. The directors say that they are unable to predict when operations at the mine will be resumed. At this time nothing of this nature can be contemplated. It is not, in their opinion, in the interest of the shareholders to order such resumption until they are fully satisfied that the works can be kept in operation without fear of further interruption.

Jumbo Extension

The Jumbo Extension Mining Co., Goldfield, Nev., for the year ended June 30, 1915, reports a profit of $339,373 from the treatment of 16,420 dry tons, averaging $45.76 gross value per ton. Of this tonnage 5,547 dry tons were milled, having an average gross value of $14.75 per ton; the loss in tailings was $8.73, and on concentrates 15c. per ton, making the net recovery $5.87 per ton on milling ore. Shipments to smelters aggregated 10,873 tons having a gross value of $61.58 per ton; smeltery losses were $4.71, making settlement on the basis of $56.87 per ton recovery. The average value realized on both grades of ore was $39.64 per ton, and all costs were $18.97 per ton, making the net realization from operations average $20.67 per ton. Costs consisted of the following charges: Mining, $3.12 per ton; development, $3.54; milling, including freight, royalties, and marketing concentrates, $1.05; freight and treatment on ore shipped, $7.29; freight and treatment on concentrates shipped, 24c.; general expenses, etc., $2.39; bullion taxes, 32c., and construction and equipment, $1.02 per ton.

The report states that the present exposures justify an estimate of 86,750 tons of ore in reserve. This estimate is made up of 49,500 tons of shipping ore, 35,750 tons of milling ore and 1,500 tons of mill ore on dumps. It is thought that the shipping ore should average about $41 by mine sample and the mill ore $7 by mine sample. The ore in the dump by mine sample runs $8.67 per ton. It is stated that the prospects for further development of ore are extremely good. The company had a cash balance of $120,533 on hand at the end of the year after paying $125,317 in dividends. The cash balance at the beginning of the year was $29,099. The company now has side-line agreements with the Booth, Goldfield Consolidated and Merger Mine companies. There are now 1,500,000 shares of stock issued.

Colorado Fuel and Iron Co.

The report of Colorado Fuel and Iron Co., owning coal and iron mines and lands in Colorado, New Mexico and Wyoming and steel works in Colorado, covers the year ended June 30, 1915. The fixed liabilities at the close of the year were $34,235,000 common stock, $2,000,000 preferred stock and $81,310,500 bonds. The only change from the previous year was a decrease of $83,000 in bonds.

The statement of production for two years past is as follows:

	1913–14	1914–15	Changes
Coal mined	2,428,992	2,329,069	D. 99,923
Coke made	535,274	520,261	D. 15,013
Limestone quarried	376,226	344,033	D. 32,193
Iron ore mined	614,039	441,026	D. 173,013
Pig iron made	268,883	286,661	D. 17,778
Finished iron and steel	352,929	324,600	D. 28,329

Of the coal mined in 1915, commercial sales took 846,278 tons; 561,775 tons were used at the company's plants; and 921,016 tons were used in making coke, showing a consumption of 1.77 tons to the ton of coke.

The earnings for the year were as follows:

	Earnings	Expenses	Net
Iron department	$10,885,451	$9,016,133	$1,869,318
Fuel department	5,692,589	5,796,848	*104,259
Total	$16,578,040	$14,812,981	$1,765,059
Total, 1914	17,803,025	16,729,255	1,073,770

* Deficit.

Income from interest and other sources was $495,042, making a total of $2,261,101. The charges for interest and taxes were $2,319,121; sinking fund and miscellaneous, $122,146; equipment renewal, $80,000; insurance, personal injury and sociological work, $74,495; total, $2,595,762, leaving a deficit of $334,661 for the year.

President Welborn's report says:

The reduction in sales was due to a curtailment in the consumption of coal in all of that territory supplied from Colorado and to lighter purchases of steel by railroads. There is little promise of improvement in buying by railroads during the current fiscal year, and we do not anticipate a volume of rail business that will keep the rail mill operating to more than 50% of its capacity. The summer demand for coal has not been up to normal, and while some improvement is anticipated in the near future, it is not believed that the business will be such as to enable us to work all of our mines to their capacity, even during the winter months. During the period of reduced consumption of coal, extending now over two years, development of new coal properties in Colorado has

continued, with the result that the productive capacity of developed mines producing domestic coal in the state is at least twice the present demand and far in excess of the prospective demand for some years. Our coal properties have been kept in good physical condition and are able to respond to whatever demand may develop, though with the increase in the number of mines operated by others, our participation in the business offered will naturally be on a reduced basis.

A plan of coöperation between the company and its employees, providing for the adjustment of differences and the consideration of other matters of common interest, through representatives selected by the workmen, has been inaugurated at the coal mines. In its formative state this plan has proven to be mutually beneficial, and its further development is anticipated in the near future.

Continued attention has been given to matters affecting the working and living conditions of the employees. Additional safety devices have been installed, and constant vigilance is being exercised to prevent accidents. Many new houses of modern type have been built, and old houses repaired and repainted as needed. At most of the camps a large percentage of the houses have been fenced, inclosing ample yards, which many of the tenants have beautified with lawns and gardens; this work of fencing will be continued until, as far as practicable, all houses have been inclosed.

Tonopah Extension

The Tonopah Extension Mining Co., Tonopah, Nev., for the year ended Mar. 31, 1915, reports a profit of $596,891. Of this amount $283,026 was paid in dividends, $123,110 expended in additions to mill and mine plant and $190,755 added to the company's cash assets. There were mined and treated 71,882 dry tons of ore, containing 2,022,220 oz. of silver and 19,040 oz. of gold, or an average of 28.13 oz. of silver and 0.264 oz. of gold per ton. Of this metal content 1,790,031 oz. of silver and 17,584 oz. of gold were recovered. The receipts from the sale of this product totaled $1,285,508, with silver at 51.507c. per oz. and gold at $20.67 per oz. The following table gives the cost of production per ton of ore before crediting interest receipts and miscellaneous earnings:

Mining costs, including all development work	$5.191
Milling costs	3.753
Metal losses in milling	2.082
Marketing costs, express	.101
Marketing costs, refining	.349
Total cost	$11.476
Profit per ton	8.490
Gross value of ore per ton	$19.966

Development work amounted to 12,651 ft., making the total development in the mine to date 84,421 ft. The milling capacity was increased from 150 to 250 tons per day by the addition of 2 batteries of 5 stamps each, 2 tube mills with Dorr classifiers, 8 Wilfley tables, 2 Dorr thickeners, 5 agitators, and 9 zinc boxes.

Chief Consolidated

The report of the Chief Consolidated Mining Co., Eureka, Utah, for the half-year ended June 30, 1915, shows a net profit of $47,019 from operations after payment of all charges. A total of 11,865 dry tons of ore was shipped, which yielded $115,712 after payment of transportation, smelting and sampling charges. The average gross value of this ore per ton was $21.78; freight, smelting and sampling charges amounted to $10.65 per ton, and the net value per ton was $11.13. The metal contents of the ore consisted of 2,322,026 lb. of lead, 267,093 lb. of zinc, 142,011 oz. of silver and 2,669 oz. of gold. Development work for the period aggregated 2,629 ft., of which 1,902 ft. were drifts. The treasurer's report shows a balance of $211,953 on hand.

North Butte

The report of the North Butte Mining Co., Butte, Mont., for 1914 shows a production of 18,421,761 lb. of copper, 1,092,300 oz. of silver and 1,107 oz. of gold. These metals were produced from 337,372 dry tons of ore and 43 dry tons of precipitates. The following sales of metals were made during the year: 21,868,479 lb. of copper at 13.7436c. per lb.; 1,377,297 oz. of silver at 55.881c. per oz., and 1,107 oz. of gold at $20 per oz. During April and May a leaner grade of ore than had heretofore been mined was encountered, and following good mining practice, it was necessary to extract and treat this ore. This, together with labor troubles at Butte and the reduction of output at the beginning of the war, was the cause of a decrease in production as compared with 1913. The cost of producing copper was 11.505c., as shown by the following table:

COST PER POUND OF COPPER

	Cents
Mining and development	7.424
Construction	.016
Freight on ore	.224
Concentrating, smelting, freight on bullion, refining, selling, etc.	6.879
General miscellaneous expense and taxes	.257
Total	14.800
Less value of gold and silver and miscellaneous income	3.295
Net cost	11.505

The mine shipped 343,314 tons of wet ore and 71 tons of precipitates. The mine was operated 309 days, with an average of 767 men. An average of 1,111 tons was hoisted per day. The financial statements show that $558,215 was made as profit and that dividends aggregating $635,000 were paid.

Butte & Superior

The report of the Butte & Superior Copper Co., Butte, Mont., covering the quarter ended June 30, 1915, shows a profit of $2,107,152 compared with $1,163,156 earned during the first quarter of the year. The net value of the zinc concentrates at the mill was $2,509,229; net value of lead concentrates and residues at mill, $230,294, and miscellaneous income, $11,899—making the total net value $2,751,423. The operating costs were $644,270, leaving the profit as stated. These profits were calculated on spelter prices of 10.364c. per lb. for April, 12.106c. per lb. for May and 15.961c. per lb. for June, an average of 12.683c. for the quarter.

The mill treated 124,080 dry tons of ore, averaging 17.003% zinc and 8.067 oz. silver per ton. There were 35,840 tons of zinc concentrates produced, averaging 52.706% zinc, making 37,780,020 lb. of zinc in the concentrates. The average silver content in the concentrates was 22.714 oz. per ton. The mill recovery on the basis of total zinc recovered in the concentrates was 89.536%. The total cost per ton for mining and milling was $5.1924, made up of $3.3816 for mining and $1.8108 for milling. It is stated that new development work has blocked out new ore in an amount substantially equivalent to the amount mined. The company is now free from bonded indebtedness.

The Pioneer Consolidated Mines Co., Pioneer, Nev., reports that all is running smoothly at the mine and mill. Considerable new development work is being started and the mill will be operated 16 hr. a day. It is stated that the mine is in a position to produce an average grade of $10 mill ore.

Arizona Copper Miners' Strike

SYNOPSIS—The strike of operatives in the Clifton-Morenci district has developed into the usual exhibit of lawlessness. Three managers were arrested without any basis for real charges and through a process which was a travesty on law.

The strike of the employees in the mines and surface plants of the copper-mining companies in the Clifton-Morenci district of Arizona has progressed from a rather unpretentious beginning to a situation that at the present time is extremely serious. Becoming general on Sept. 12, the strikers tied up the mines and reduction plants of the district and violence has been unchecked. Agitators from the Western Federation of Miners have been largely instrumental in stirring up the men, while Mexican agitators have performed their share among those of their color.

According to the statement of Walter Douglas, general manager for Phelps, Dodge & Co., the strike was called on Sept. 11 by the Western Federation of Miners. "Bodies of men, principally Spanish and Mexicans, prevented the men that so desired from going to work. Pickets were immediately placed in mines, converters, power houses and smelters, and the companies' officers were refused permission to enter. The companies immediately withdrew all their watchmen and called upon the sheriff to protect their property. Only through direct orders from the state Corporation Commission to the sheriff was it possible to start up the electric plant to furnish light to the town, Morenci being in complete darkness for three nights.

"The strikers refused to permit mine pumps to be operated or drawn or to allow machinery to be cared for or belts taken off for their preservation. They even forbade the mules being fed or hoisted to the surface, until persuaded by the sheriff to allow them to be taken from the mines.

"The wage question is simply a pretext for the unionizing of a camp that in the past has never discriminated against any man on account of his affiliation. On the sliding scale introduced four months ago, labor of all classes has been receiving higher pay than ever before, nor has there been any grievance or complaint on this score.

"The Western Federation of Miners, aiming at political domination of the state, has introduced its agitators and organizers into the district, knowing that Mexican workmen are easily led and more easily intimidated, and has exercised its arbitrary and despotic methods to bring suffering and loss on a formerly happy and contented community.

"As regards the matter of wages, Americans, constituting about 30 per cent. of the employees and occupying positions of trust and skill, receive the same pay as in other mining camps of the Southwest, while miners and unskilled laborers are composed largely of Mexicans and Spaniards, whose wages exceed those paid for similar labor elsewhere.

"The Morenci-Clifton-Metcalf district comprises the highest-cost mines of the state, the copper of the largest producer costing nearly 13c. As the average price for copper for the last 10 years is less than 14c., it is obvious that they can hardly earn interest on their investments and equally obvious that it is commercially impossible to increase wages and continue operations."

In this connection it is interesting to note the accompanying table, which sets forth a comparison between the costs under the prices paid at the present time and the wage scale insisted upon by the Western Federation of Miners. It is to be remembered that the Western Federation of Miners bases its scale of wages on 13c. copper or lower. The present sliding scale is designed to prevail when copper is above 13c.

METCALF MINE OF ARIZONA COPPER CO., AT METCALF, ARIZ., SHOWING A PART OF THE DISTRICT WHERE STRIKE CONDITIONS NOW REIGN

DETROIT COPPER MINING CO. WAGE SCALE AND WESTERN FEDERATION OF MINERS' SCALE

Based on Wages Paid Last Half of July and First Half of August, 1915

	Detroit Copper Present, 13c. Cu	Western Fed. of Miners, 13c. Cu	Detroit Copper Present, 18c. Cu	Western Fed. of Miners, 18c. Cu
Mines	$58,462	$91,356	$67,091	$108,074
Concentrating	16,829	20,898	19,520	24,722
Smelting and converting	7,944	10,057	9,092	11,897
Mechanical	7,749	8,925	8,933	10,558
Miscellaneous	4,518	4,876	4,935	5,052
Per month	$95,502	$136,112	$109,571	$160,303
Per year	$1,146,024	$1,633,344	$1,314,852	$1,923,636
Difference per year		$487,320		$608,784
Difference between present 18c. rate and Western Federation of Miners' minimum per year				$318,492

According to these figures the difference per year for the entire district would be about $2,000,000.

The accompanying schedule shows the demands made by the Western Federation of Miners upon the copper companies operating in the district.

1. Reinstatement of all men discharged since Sept. 1, 1915.
2. Reinstatement of all men who went out on strike, with no discrimination because of membership in any society, association or organization, either now or at any other time.
3. Eight hours' pay per day.
4. Hospital board free to employees.
5. Wages asked for herein are based on 13c. copper or less.
6. Present sliding scale shall prevail when copper is above 13c.
7. Abolition of doctor's examination.

MINIMUM WAGE SCALE FOR CONCENTRATOR MEN

1. Construction department. Laborers, $2.50.
2. Swampers in mill, screen men—wet and dry—sweepers in bins and crushing plant, $3.
3. Table operators, vanner operators, table repairmen, vanner repairmen, $3.50.
4. Sample men, $3.25.
5. General repairmen, $3.75. General repair helpers, $3.
6. Flotation machine operators, $3.50.

MINIMUM WAGE SCALE FOR SMELTER

Nothing Under $3 in the Mill

1. Skimmers, $4. Helpers, $3.25. Punchers, $3.25.
2. Electrical department: Cranemen, $4.25. Copper man, $3.
3. Slag engineers, $4.25. Copper weighers, $3.75.
4. Feeders, slag tappers, matte tappers, $3.50. Helpers, $3.25.
5. Repairman, $4.25. Helper, $3.25.
6. Converter punchers, $3.25. Crane swamper, $3.
7. Wheelbarrow men, $3. Slag-train brakeman, $3.
8. Other laborers, $2.50.

MINIMUM WAGE SCALE FOR MINES

Nothing Under $3 Underground

1. Miners, $3.50. Timbermen, $3.75. Shaft men, 50c. advance over scale.
2. Contract miners shall receive at least miners' wages.
3. Motormen, cagers, skip-tenders, $3.50.
4. Track men, $3.75. Tool nippers, $3.
5. Muckers, trammers, top-landers, and other laborers, $3.
6. Hoist men, single-drum, $4.25; double-drum, $4.50.
7. Pumpmen, $4. Tool sharpener, mine blacksmith, $4.
8. Samplers, $3.50. Surface laborers, $2.50.

MINIMUM WAGE SCALE FOR THE FOLLOWING CRAFTS

Machinists	Carpenters	Pipefitters
Boilermakers	Carmen	Power-house employees
Blacksmiths	Patternmakers	Electricians
Molders	Coppersmiths	Electrical operators

1. That $4.25 be the minimum wage for the following crafts.

Machinists	Coppersmiths	Carpenters
Boilermakers	Pipefitters	Electrical operators
Blacksmiths	Molders	

2. Boilermaker laying out the work to receive 5c. per hour more than the above scale.

MINIMUM WAGE SCALE FOR OTHER CRAFTS

Electricians, shift men	$4.75	Firemen	$3.50
Day electricians	4.25	Oilers	3.00
Electrician helpers	3.50	Patternmaker	5.00
Engineers	4.56	Car repairers	3.60
Switchboard operators	4.00	Wiper	2.50

3. A competent boiler-shop foreman.

MINIMUM WAGE RATING FOR HELPERS

Boilermaker helpers	$3.50	Machinist helpers	$3.50
Blacksmith helpers	3.50	Pipefitter helpers	3.50
Molder helpers	3.50	Car repairmen helpers	2.50

After considering these demands the companies, after consultation, decided to refuse them and the following letter was addressed to the strikers:

To the Committee representing the former employees of the Arizona Copper Co., Ltd., the Detroit Copper Mining Co. of Arizona, Shannon Copper Co.:

Gentlemen—In answer to your representations we beg to call your attention to the fact that these companies have seen their properties closed down and their operations tied up completely by a strike called by the Western Federation of Miners and this without any presentation of grievances. Our former employees have been persuaded by agitators of the Western Federation of Miners coming from outside of this district that the past pleasant relations and the present rate of wages should be radically changed.

In view of these facts and notwithstanding that the companies are convinced that a large number of their old employees desire to continue to work under the conditions formerly existing in this district, they realize that any attempt to recommence under such conditions would be to invite violence and intimidation. Therefore the managements of the Arizona Copper Co., Ltd., Detroit Copper Mining Co. and Shannon Copper Co. desire to notify the committees and the people of the Clifton-Morenci-Metcalf district that their mines and plants will remain idle indefinitely.

When it shall appear that conditions in this section warrant it and the companies are satisfied that the general sentiment of the community and their former employees is unanimously in favor of a resumption of operations on the basis of wages and conditions which have prevailed heretofore in this district, the companies reserve to themselves the right to decide whether or not they will again start up their plants.

Our attitude in this matter is based solely on the dominant influence of the Western Federation of Miners in this district at the present time, and when this influence is dissipated we may take a different view of the situation.

THE ARIZONA COPPER CO., LTD.,
By Norman Carmichael, General Manager.
THE DETROIT COPPER MINING CO. OF ARIZONA,
By M. H. McLean, General Manager.
SHANNON COPPER CO.,
By J. W. Bennie, General Manager.

After the receipt of this reply conditions continued to grow worse, violence being threatened on every hand by the strikers.

It is stated that Western Federation agitators had been trying to create a disturbance for some weeks prior to the calling of the strike, but with little success. To oppose these efforts, satisfied employees had circulated a petition announcing their satisfaction with conditions and asking that the camp be not unionized. Upon learning of this petition the Federation officials called the strike immediately, to forestall the submission of the petition which had already received about 600 signatures.

Activities of Arizona's Governor

An interesting development was that after two days spent in Clifton and Morenci, taking testimony of mine managers and employees, Governor Hunt and Adjutant-General Harris left Thursday evening, Sept. 30, for Phoenix. The meeting was held late Thursday at Clifton, at which more than 300 persons were present. The announcement made by the governor afterward was: "I find conditions existing here that require adjustment. I feel that men who have charge of these great works will be amenable to reason, and I believe they will meet you on common ground. When I come back to this community and have to bring troops, the principal officers of the companies will be no different from the poorest Mexican they control. I hope all of you realize that I am going to have order if I have to call on every troop we have in Arizona. I do not want to come to this district except to bear the olive branch of peace, but if war comes you will have to abide by war. There never was a condition but that it could be improved, and I feel that employers and employees can get together, and if they cannot get together peacefully, they will have to get together some other way, because I am going to see you people get together some way, if I have to put every one of you in the bull pen."

After this remarkable effusion of frothy pother, the governor left the district, apparently assuming that he had settled the whole thing. The report is being circulated that the mine managers told the governor that as soon as the Western Federation organizers left the camp, there would be no difficulty in reaching an amicable agreement. There is no record, however, that the governor paid any attention to their remarks.

The change in conditions is shown clearly by the accompanying telegram, which was sent from Morenci Saturday evening: "Great demonstration in front of Norman Carmichael's office this morning. Master Mechanic Dawson was assaulted and made to march in front of mobs bareheaded. Dawson was very cool and was finally taken to jail by the sheriff. Mobs carried banners with violent inscriptions—'Down with the managers; they are too proud to be employees, but not too proud to lie to us;' 'We will fight before we starve;' etc. Strikers feel much stronger in their position since governor of Arizona's visit, which has had bad, very bad effects. Governor of Arizona's statement, which you have, was greatly tempered by newspaper reports, which beat him to it.

"We believe Norman Carmichael to be in great danger. On that account manager of Shannon Copper Co. proposes that managers leave district tonight. This will be done provided Carmichael can find opportunity to escape; demonstration in progress here now; about 2,500 men; banners more suggestive than those of this morning; am going to Clifton to insist that Norman Carmichael leave; will return to Morenci and arrange to leave myself a little later. There is not any mistake about danger to Norman Carmichael's life. Absolutely no protection for anyone."

(Signed) M. H. McLean.

The suggestion of the telegram, that the managers leave Clifton, was followed. They left on a blind locomotive and succeeded in reaching Lordsburg, N. M. Norman Carmichael, of the Arizona Copper Co., Milton McLean, of the Detroit Copper Co., and J. W. Bennie, of the Shannon Copper Co., were the three who escaped. Upon their arrival at Lordsburg they were immediately placed under arrest by Sheriff H. C. McGrath, Deputy Sheriff Joe Larrieu, of Clifton, swearing out a warrant charging them with being fugitives from justice. It was reported that Sheriff Cash, of Greenlee County, Ariz., was *en route* to Lordsburg, bearing a felony warrant. The managers expressed a desire to remain under the protection of the New Mexican authorities, fearing personal injuries at the hands of the strikers.

Mine Managers Reach El Paso

The warrant for the arrest of the three managers was sworn out by a Mexican laborer and the charge was inciting riot. A justice of the peace discharged them for lack of evidence.

The fleeing mine managers reached El Paso late Sunday and issued this statement:

"The incidents of the day and the temper of the strikers were such yesterday that the managers and disinterested observers were of the unanimous opinion that there would be bloodshed within 24 hr. if the managers did not withdraw themselves from the district; that their presence was a constant and increasing source of irritation to the strikers just as the presence of nonresident federation leaders was an irritation to the managers. Notwithstanding that the sheriff is carefully guarding the properties of the companies, the district is in the absolute and complete control of the Western Federation of Miners. Therefore there was nothing left for the managers to do and they could serve best their respective companies and the state by removing themselves from the district. Troops ought not to be needed now."

It is further stated from Phœnix, under date of Oct. 3, that Adjt.-Gen. C. W. Harris and 48 militiamen started at night for Clifton, to preserve peace in the strike of the miners there. The militiamen were ordered to Clifton by Governor Hunt on receipt of an appeal from Sheriff Cash, who said he feared the situation was beyond his control. Cash said the managers of the copper companies had abandoned the district and that the strikers were parading the streets and making demonstrations. He feared that serious trouble would result.

Thomas Simpson and Mike Penn, engineer and fireman respectively of the engine upon which Messrs. Carmichael, Bennie and McLean escaped from Clifton, were severely beaten by the mob upon their return from the trip. They escaped further punishment by getting away in a fast automobile.

A telegram received at New York on the morning of Oct. 6, from Milton McLean, manager for the Detroit Copper Co. is as follows: "Situation at Morenci steadily growing worse. Eight explosions of dynamite at Arizona Copper Co. mill last night. No damage reported. Terrifying town. 150 leaving tomorrow morning, 70 by order of men on strike and County authorities. The number steadily increasing. Western Federation of Miners leaders say explosions are work of company men. They will make their headquarters Hotel Morenci and say they will occupy my house. Arizona Copper Co. general office and drug store stoned. Stores promised protection which is doubtful."

New Jersey Iron Mines Prosper

Continued demands for munitions, according to the New York *Times*, have created a demand for products of the mines in Morris County, New Jersey, foremost among these being the Empire Steel and Iron Co. at Mount Hope and the Thomas Iron Co. at Richard Mine. The former is shipping about 17,000 tons of ore a month, and the latter about 6,000 tons. The Thomas Iron Co. has also purchased the stock on bank of the Hough Mining Co. at Wharton, and this is being shipped to the company's furnaces at Hellertown, Alburtis and Catasauqua, Penn.

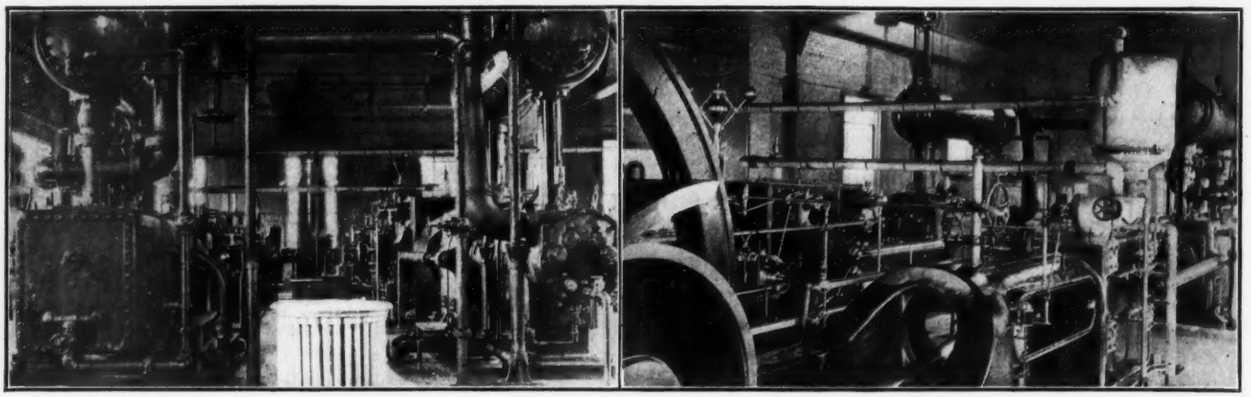
Much of the ore mined by the Empire Steel and Iron Co. at Mount Hope is being shipped to the Bethlehem Steel Co. Notices were posted on Oct. 1 at the office of the Thomas Iron Co., advising the employees of a 10% increase in wages. The average wage before this morning's announcement was: For drill runners, $2.20; for pump men, $2, and for laborers, $1.93 for an eight-hour day.

Clifton-Morenci Wages

The Detroit Copper Mining Co. states that the wage scale as given in the *Journal* of Sept. 25, should be: For Mexican miners, $2.73 to $2.88 a day; American miners, from $3.30 to $3.78; Mexican timber-men, $2.88; the more skilled American timber-men, from $3.56 to $4.04 a day.

Boring for Petroleum is in progress at Kingston and Robe in South Australia, and the wells are now down about 1000 ft., with good prospects. G. D. Mendell, of Melbourne, is in charge of the operations. American drillers are working on the wells. Oil has been found in Papua and in several other islands on the north coast.

Photographs from the Field



THREE-STAGE 900-LB. PRESSURE AIR COMPRESSOR AT THE ELLISON SHAFT OF THE HOMESTAKE MINING CO. AT LEAD, S. D.

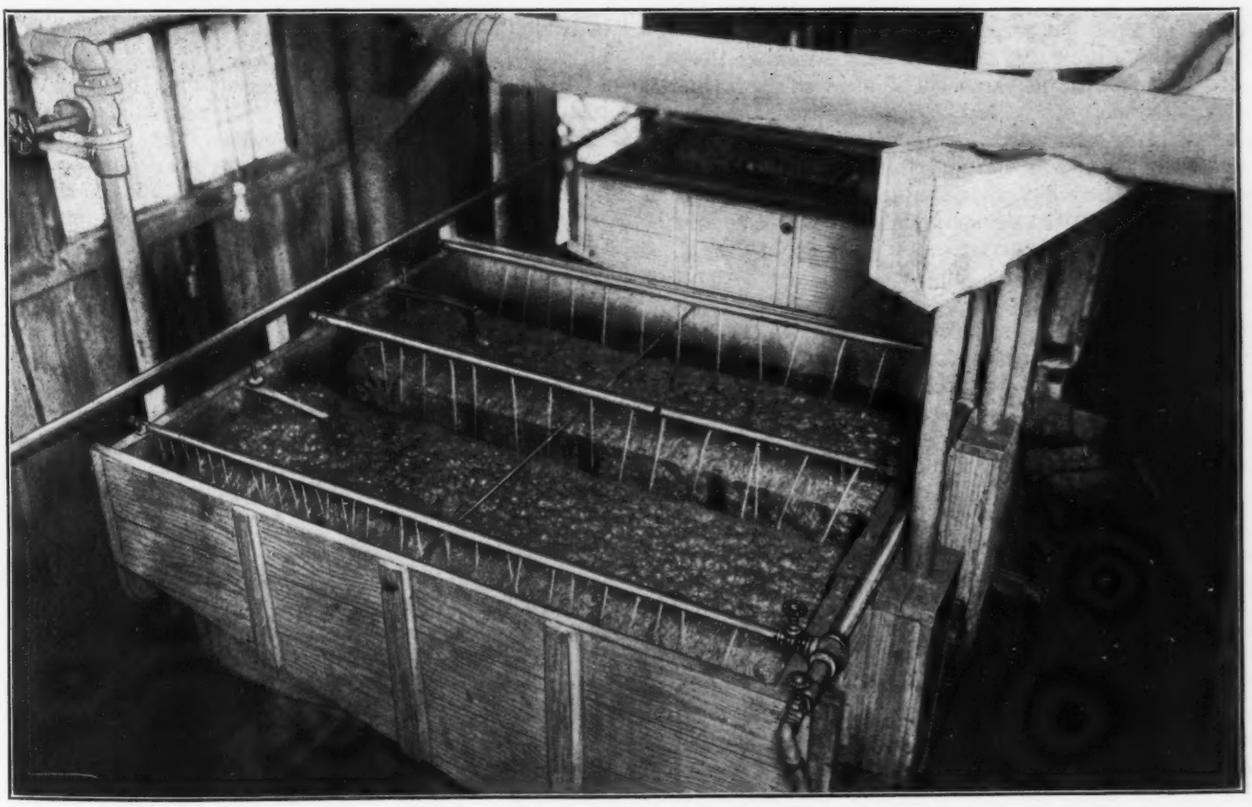
OPENCUT MINING AT WASP NO. 2, FLATIRON, S. D. ORE IS 30 FT. WIDE, 20 FT. THICK, AND ASSAYS $2 PER TON

STARTING A 10x30-FT. STOPE AT WASP NO. 2

ORO HONDO SHAFT, 1700 FT. DEEP, NEAR LEAD, S. D.

INTERSTATE-CALLAHAN MILL, NINE-MILE CANYON, NEAR WALLACE, IDAHO

This property entered the producing stage at the time when the highest prices for zinc ruled, due to war orders. Consequently the company earned a great deal of money, its July dividend amounting to $575,000, followed by one in August of $920,000. Standard systems of jig and table concentration are used, followed by an interesting variety of flotation equipment



CALLOW FLOTATION PROCESS INSTALLED AT THE ANACONDA'S REMODELED CONCENTRATOR

Flotation promises to be of great service in treating copper ores; so much so that leaching is thought by some to be in danger of extinction in such plants

Editorials

Clifton-Morenci Strike

The strike at Clifton-Morenci, which at first was not regarded seriously—at least not here—has developed into an extraordinarily bitter labor trouble, and it exhibits features that are unusually alarming. In the disorder and rioting and attacks upon mine officials, there is a resemblance to the Lake Superior strike of 1913. A further point of similarity is to be found in the prompt appearance on the scene of that stormy petrel, Moyer, who is always on hand in such affairs.

The elements of this strike are evidently the usual demands for increased wages and recognition of the union, the latter having been dropped, however, early in the negotiations. The miners of Clifton-Morenci have heretofore been paid on the sliding scale, governed by the price for copper, that now prevails as a system in most of the copper-mining districts west of the Rocky Mountains. However, the scale at Clifton-Morenci has been lower than at the other copper-mining districts of Arizona. The reason for this has been the relative inferiority of the class of labor available, the mining population at Clifton-Morenci being to a large extent Mexican, partly immigrants and partly descendants of the Mexicans that were living in that region when it was acquired by the United States. A large portion of these Mexicans are, therefore, naturally citizens of the United States, not merely naturalized.

Now it is pretty well established in mining that the laborer gets what he earns. The most efficient labor is always the most economical, and the big companies secure it by offering wages that are attractive. Thus the highest wages are paid at Bisbee and Butte, and the companies operating there enjoy probably the most efficient class of labor. When the supply of miners is short they may be obliged to hire inferior men, but when demand slackens the inferior men are promptly weeded out.

Something of this sort is exhibited in the economic conditions of the Clifton-Morenci district. The labor there is generally inferior. Consequently the rates of wages are lower than elsewhere. This manifests itself in the cost of producing the copper. The three principal companies of Clifton-Morenci—the Detroit, Arizona and Shannon—rank on the whole as high-cost producers, relatively speaking. The managers have pointed out that if the demands of the men were granted, the companies would be unable to make any money if copper were at its normal level, although of course they would still make some money with copper at the present high level.

So much for the merits of the case. In the development of the strike there were early manifestations of disorder, and the several companies felt themselves constrained to put their property into the hands of the sheriff of the county, making the state responsible for its safety. Then the governor of Arizona appeared on the scene, endeavoring to play the part of mediator. His actions were silly and his talk was mere flubdub. Both contributed to make matters worse. Indeed, it might not be going too far to characterize the governor's talk as inflammatory. The policy of the responsible authorities of the state, especially the governor, was manifestly to play politics and win the vote of the Mexican population of Arizona and unionized labor generally. Finally the turbulence increased to such an extent and the hostilities to the three mining managers became so virulent that they actually stood in danger of their lives. They remained at their posts longer even than they should have done, especially Mr. Carmichael. His associates had hard work to drag him away, but finally they succeeded in doing so, and the three managers escaped on a locomotive, which was driven over the line to Lordsburg, N. M., at night, without lights—a perilous journey. Arrived at Lordsburg, the three managers were arrested by the sheriff of Grant County on a warrant sworn out by a Mexican at Clifton, charging them with being *fugitives from justice.*

Respecting Subway Timbering

B. B. Thayer declined to serve on the committee of engineers to advise the Public Service Commission about the safety of the New York subways under construction, and the commission is therefore going ahead with a committee of two, of whom neither is a mining engineer. This is a pity.

In the last number of the *Journal* the system of timbering used in the New York subways was illustrated, and comparison with the original form of square-setting used in mines was made, a method of mine-timbering reproduced from a Comstock print of the '70s being shown. It was not the purpose to advise that this system of mine timbering should necessarily be adopted in the subways, but rather to indicate the radical difference in ideas.

The fundamental principle of mine timbering is not to hold up rock by trying to carry the whole load, but instead thereof to keep it in place, to prevent it from slipping. It is rare in underground work that a large block of ground comes down unless it be brought down intentionally, as in the caving system of mining. The great danger in mining from what are called "falls of ground" is the dropping or sliding of blocks and slabs relatively small. This is met by keeping the timbering wedged up tightly to the face of the rock. In narrow veins the support may be simple stulls. In large, cavernous openings it may be timbers arranged in square sets.

Now timbering is not necessary in all cases. There are kinds of rock in which large chambers may be opened deep in the bowels of the earth without a stick of timber having to be put into them. There are others in which the only precaution is to cut out the roof in the form of an arch. But there are others which must be filled with a timber structure.

In the last case the timbers, usually 10x10 to 12x12 in. in size, are built up in the form of skeleton cubes, usually

about 6x6x6 ft. and rarely as much as 8x8x8 ft. In certain cases knee braces (angle braces) are added. The several members of a set come together in butt joints. Respecting the manner of making these joints there is an extensive literature. For the framing of the timbers for this purpose there are special machines, although the work can be done by hand, and formerly was always done so.

The result of such timbering is that the "stope," or cavernous opening, is filled with a multitude of relatively small cells, just as a child builds a structure of blocks, but the framework is always kept close to the rock faces and wedged in. If the ground is loose the outside of the structure is inclosed by horizontal lagging, usually of rough, round sticks laid closely. Upon the horizontal members of the framework, plank are laid to form floors on which the miners may work.

When an underground opening is timbered in this way one or several of the sets may accidentally be shot out or may be crushed in, but nothing very serious happens. The trouble is distinctly localized.

Let it be noted that in mining the purpose is to extract material at the minimum of cost and often some very close figuring is necessary. In many mines the item of timbering is a relatively large one, and it may be accepted as an axiom that no mining engineer does any more of it than he has to. In the construction of the New York subways, which cost four million dollars or so per mile, there is not the same necessity for close figuring in this respect.

We are not to be understood as recommending that the New York subways during construction ought to be timbered by the square-set method. Without any doubt a study of the problem would result in the development of a special method, which might be a modification of the square-set system. It may be said confidently, however, that simple square-setting would permit the excavation of the ground as well as the method heretofore used, while with respect to the reclaiming of timber for reuse as the work progressed square-setting would be more advantageous. Although further discussion of this subject is likely to be of only academic interest, there would be some entertainment for mining engineers, during the winter evenings that are coming, in devising plans for timbering subways in cities as they ought to be.

A summary of the report of the committee of two inspecting engineers was published on Oct. 5. It indicates that they have no real comprehension of the problems of supporting ground from the standpoint of the mining engineer.

First-Aid Contests

The widespread interest in first-aid contests throughout the mining districts, not only of the coal fields of the East but also in the metal-mining regions west of the Rocky Mountains, is based no doubt upon the common desire of our people for a sport in which many may participate. The games of the East have never had any great vogue in the West. There is many a mining camp where there is not a level place big enough for a baseball diamond. One of the great sports of San Francisco in the '50s was running with the fire engine, and from there it was naturally transplanted to Virginia City and to the other great mining towns. As recently as the latter '80s the annual contest of fire-engine teams, coming from Aspen, Red Cliff, Gunnison, etc., was the great event of the year at Leadville, Colo. Drilling contests never aroused the same interest. People want some sport that gives a chance for the development of teamwork. This is found in the first-aid work, which combines the opportunities for good teamplay with the interests and hazards of an obstacle race. It is a fine thing, for it is not only a subject of interest, but also it serves a highly useful purpose.

Waste of Hiring and Firing

The economic waste involved in the indiscriminate hiring and firing of employees has not been studied with care in respect to the mining industry, but a recent address on this subject confined to manufacturing lines forces some very startling conclusions. The figures given apply to 12 different establishments employing about 40,000 men, and the speaker estimated that the money lost in one year due to the problem of hiring and firing amounted to $831,030. He fixed the cost for the purely clerical work of hiring and recording discharge at 50c. per person.

Just how much parallelism there is between manufacturing and mining, in this regard, it is not necessary to discover for the purpose of emphasizing this point, so often overlooked. When a miner gets huffy and demands his time on the spot, the bother and inconvenience to the foreman and shift bosses and to the clerical force in the office are perfectly obvious, and are invariably resented in a psychological way, at least, and a money cost of the transaction might easily be figured, which does not come to mind when, for some equally trivial reason, the man may be handed his time.

Aside from the purely clerical cost of the hiring and the discharge, is the large economic waste involved in instructing a new man in his duties, if it be only to the extent of conducting him to his place of work and informing him where he will find the tools with which to work, and getting him acquainted with the system employed at that particular mine. If he is simply taken to the heading and turned loose on a drill, he is at a loss to know where his wrenches are, the air-pipe connection, the air valves and various other things, and he will lose a large amount of time ferreting out the knowledge he must have. While he is doing his best to acquire the information which should have been given him at the start, he may make some mistake that will get him an immediate discharge from an irascible foreman or superintendent. This is where the big item of waste in this problem comes in.

Next to the irascible superintendent, the new superintendent is the greatest offender in this regard. His strong point in his own mind when he first attains authority, is his willingness to exhibit the courage of his convictions by firing promptly any man who does not come up to the chalkmark of expectations. He calls it enforcing discipline. The inexperienced superintendent is wholly unaware of the long period his predecessor required to build up his organization, the paternal way in which he sometimes had to handle his men, and he has not yet learned that an efficient superintendent must know what not to see just as well as what he should see.

While he has probably never figured out the cost in dollars and cents, the experienced handler of men, unless the cause is unmistakably flagrant, is rarely quick on the trigger at discharging employees.

BY THE WAY

According to the *Evening Sun* a visitor filled out the form handed him by the office boy as follows:

Mr. Blank desires to see Mr. Marquis in regard to selling him stock in a false-teeth mine.

Well? We've seen stock in worse ones actually sold.

⁂

Sometimes ore representatives receive queer letters of instruction, of which the following is a sample:

i wil send to your smelting Co. a shiping of ore Nex week and a orden with it you to get your money out of it and you look out for the ore i let my Pardman look after the settle up of the last shiping and i thought everything was Punk.

JOE SMITH.

P. S. look out for the Nex week sure ore.

⁂

According to a Western journalist, Quong, the Chinese lawyer of Socorro, N. M., looking at $23,000 worth of Ernestine Mining Co.'s bullion stacked in front of the express office, computed in good pidgin English: "One high ball one bit, two high balls two bits. Good Godfley, one hundred eighty-four thousand high balls there!" and went musing down the street.

⁂

The Bureau of Mines has certainly justified itself if the newspaper report be correct that "embedded under 100 ft. of solid earth a silver vein more than a mile long and 7½ ft. wide, said to contain nearly $1,000,000 worth of pyrites silver ore, has been discovered on the United States Bureau of Mines site in Oakland, Penn., a suburb of Pittsburgh." However, we shall await further details before becoming excited.

⁂

Recent sales of Southern No. 2 foundry iron at $12.50 per ton, Birmingham, must be rather gratifying to two or three large speculators who bought quite freely of that grade at $9.50 some three months ago. The advance is not quite so spectacular as that of some of the "war babies" on Wall Street, but it is solid and seems likely to hold for a while. Makers who are delivering iron under the $9.50 contracts may take a different view of the situation.

⁂

Speaking of mining investments, we know of a young man who, desiring on occasion to make an impression on the mother of his best girl, borrowed from his numerous friends various quantities of stock in questionable mines to be returned forthwith. The array having been displayed with the telling effect intended, our friend was about to return his borrowed certificates when he became confused and was unable to tell which was which. He ingeniously overcame this difficulty by ingenuously asking each one how many shares he had borrowed from him, and then counting out to him the same number indiscriminately from his collection. The ingenuity of his decision and solution of his difficulty would seem to have been amply rewarded by the fact that he never had a single kick from any of the people with whom he had this stock transaction.

⁂

Speaking of the early days on the Comstock, Charles E. Van Loan describes interestingly in the *Saturday Evening Post* the exploits of the "bad men" of the period. But life in the '60s was not all violence and bloodshed; under the froth there was a solid citizenry. The miners—by far the largest single element in the camp—were a kindly people, and many of their customs might serve as models for any community. The entire city contributed liberally to the support of the widows and orphans, and when a man was hurt or killed in one of the numerous underground accidents it was the usual thing for every man working in the mine to chip in to the extent of one day's pay—four dollars. "If a man was sick," said one of the Comstock veterans to Mr. Van Loan, "the scene at his bedside was like a conference of the nations. Americans, Englishmen, Irishmen, Swedes, Germans, Mexicans, Bohunks—even the Chinamen—would drop in to see if there was anything they could do. They were the best and the biggest-hearted people in the world; nothing was too much trouble if a man needed help."

⁂

September Mining Dividends

Dividends disbursed in September, 1915, by 33 United States mining companies making public reports amount to $10,708,720, as compared with $3,280,058 in September, 1914. Industrial and holding companies allied to mining paid $6,900,586, as compared with $10,995,380, a year ago. Canadian and Mexican companies paid $784,380, as compared with $537,756 in September, 1914.

The totals for the first mine months of the year are as follows: Mining companies, $51,399,883, as against $45,690,640 in 1914; metallurgical and holding companies, $61,726,344, as against $68,603,024 in 1914; Canadian and Mexican mines, $6,082,120, as against $12,602,124 in 1914. The drop in the payments by industrials is entirely due to the passed dividends on U. S. Steel common.

United States Mining Companies	Situation	Per Share	Total
Argonaut, g	Calif.	$0.06	$20,000
Brunswick, g	Calif.	.06	23,717
Bunker Hill & Sullivan, l.s	Ida.	.25	81,750
Bunker Hill Con., g	Calif.	.02½	5,000
Butte & Superior, z	Mont.	5.75	1,564,637
Calumet & Hecla, c	Mich.	15.00	1,500,000
Calumet & Arizona, c	Ariz.	1.00	617,385
Chino, c	N. M.	.75	652,455
Champion, c	Mich.	2.00	200,000
Federal M. & S., l.s. pfd	Idaho	1.00	119,861
Golden Cycle, g	Colo.	.02	30,000
Hecla, l.s	Idaho	.07	70,000
Homestake, g	S. D.	.65	163,254
Jumbo Ex., g.s	Nev.	.07½	72,876
Magma, c	Ariz.	.50	120,000
Nevada Con., c	Nev.	.37½	749,796
North Star, g	Calif.	.20	50,000
Old Dominion, M. & S., c	Ariz.	1.50	243,000
Oroville, g	Calif.	.12	78,270
Plymouth Con., g	Calif.	.24	58,520
Quincy, c	Mich.	2.00	220,000
Ray, c	Ariz.	.37½	547,035
St. Joseph, l	Mo.	.25	352,350
Seven Troughs Coalition, g.s	Nev.	.02½	36,076
Stewart, s.l	Idaho	.10	123,826
Success, z	Idaho	.06	90,000
Superior & Pittsburgh, c	Ariz.	.38	569,922
United Globe, c	Ariz.	9.00	207,000
Utah, c	Utah	1.00	1,624,490
Utah Con. c	Utah	.50	150,000
Wasp No. 2, g	S. D.	.01	5,000
Yellow Pine, l.z.c.s	Nev.	.10	100,000
Yukon, g	Alaska	.07½	262,500
Iron, Industrial and Holding Companies	**Situation**	**Per Share**	**Total**
Am. Sm. and Ref. Co., com.	U.S.	$1.00	$100,000
Am. Sm. and Ref. Co., pfd.	Mex.	1.75	875,000
General Development	U.S., Mex.	1.50	44,982
Inland Steel	Ind.	2.00	157,672
International Nickel, com	U. S.	5.00	1,901,575
La Belle, pfd	U. S.	1.00	99,154
National Lead, com	U. S.	.75	154,916
National Lead, pfd	U. S.	1.75	426,433
Old Dominion of Maine, c	Ariz.	1.50	393,354
Pittsburgh Steel, pfd	Penn.	1.75	112,500
Phelps, Dodge & Co	U.S., Mex.	5.50	2,475,000
St. Mary's Mineral Land, c	Mich.	1.00	160,000
Canadian, Mexican and Central American Companies	**Situation**	**Per Share**	**Total**
Caribou-Cobalt, s	Ont.	$0.09	$90,000
Dome, g	Ont.	.50	250,000
Hedley, g	B. C.	.50	60,000
Hollinger, g	Ont.	.20	120,000
Kerr Lake, s	Ont.	.25	150,000
Lucky Tiger, s.g	Mex.	.09	64,380
Standard Silver-Lead, s.l	B.C.	.02½	50,000

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALLOYS—A New or Improved Process for the Preparation of Alloys Containing Copper and Lead. L. Sempell, Duisburg, Germany. (Brit. No. 28,492 of 1913.)

ALLOYS—Process for the Production of Alloys of High Melting Point Having Ductile Properties. Wolfram Lampen Akt., Augsburg, Germany. (Brit. No. 29,980 of 1913.)

BRIQUETTES—Machine for Making Briquettes. Ellsworth B. A. Zwoyer and Rolland A. Zwoyer, Perth Amboy, N. J., assignors to Zwoyer Fuel Co. (U. S. No. 1,152,468; Sept. 7, 1915.)

CEMENT—Method of Burning Portland Cement Clinker. Thomas A. Edison. Llewellyn Park, Orange, N. J. (U. S. No. 1,152,613; Sept. 7, 1915.)

COKE—Apparatus for Utilizing the Heat of Coke Cakes. Carl Semmler, Wiesbaden, Germany. (U. S. No. 1,153,453; Sept. 14, 1915.)

CONCENTRATING TABLES, Head Motion for. William Armor Stedman, Wonder, Nev. (U. S. No. 1,153,723; Sept. 14, 1915.)

CONCENTRATOR TABLES—Protective Covering for Concentrator Tables and Method of Applying the Same. Everest A. Baylis, Madera, Mexico, assignor to J. A. McMahon, El Paso, Tex. (U. S. No. 13,981; reissue Sept. 20, 1915.)

CONVERTER for Treating Matte. William H. Howard, Garfield, Utah. (U. S. No. 1,153,921; Sept. 20, 1915.)

CONVEYORS—Improvements in or Relating to Coal and the Like Conveyors. S. A. Ward, Sheffield, England. (Brit. No. 23,084 of 1914.)

CONVEYORS—Improvements of Jig Conveyors. H. Flottmann & Co., Herne, Westphalia, Germany. (Brit. No. 10,184 of 1914.)

COPPER—Improvements in and Relating to the Extraction of Copper. E. R. Weidlein, Pittsburgh, Penn. (Brit. No. 10,500 of 1914.)

CRUSHING—Ball Mill. Frank E. Marcy, Salt Lake City, Utah. U. S. No. 1,153,239; Sept. 14, 1915.)

CRUSHING—Lining for Pebble or Ball Mills. Hans A. Hansen and Joseph M. Schmueser, Smuggler, Colo. (U. S. No. 1,153,844; Sept. 14, 1915.)

CRUSHING—Screen Grate for Ball Mills. Frank E. Marcy, Salt Lake City, Utah. (U. S. No. 1,153,238; Sept. 14, 1915.)

CYANOGEN COMPOUNDS—An Improved Process for the Production of Cyanogen Compounds and a Furnace for Carrying the Same into Effect. A. R. Lindblad, Ludvika, Sweden. (Brit. No. 22,852 of 1914.)

DREDGES—Clam-Shell Dredger-Bucket Buffer. Peter Peterson, San Francisco, Calif. (U. S. No. 1,153,950; Sept. 20, 1915.)

DREDGES—Power Spud for Dredges. Earl W. Dotten, Aitkin, Minn. (U. S. No. 1,154,492; Sept. 20, 1915.)

DRILL CHUCK. William Farquharson, Greenock, Scotland. (U. S. No. 1,154,209; Sept. 20, 1915.)

DRILLING MACHINES—Improvements in Coal and Rock-Boring Machines. A. Berner, Nuremberg, Germany. (Brit. No. 18,404 of 1914.)

DRILLS—Improvements in Hydraulic Rock and the Like Drills. J. Hanson, Penrhyndendraeth, North Wales. (Brit. No. 17,689 of 1914.)

DRILLS—Rotating Device for Rock Drills. Charles Otis Palmer, Cleveland, Ohio. (U. S. No. 1,153,700; Sept. 14, 1915.)

ELECTRODE FURNACES—Improvements in Electrode Furnaces which Have an Arrangement for Automatically Mixing Up the Charge. E. Krupp Akt., Essen, Germany. (Brit. No. 742 of 1914.)

FLOTATION—Improvements in Separation of Mixed Sulphide Ores. Minerals Separation, Ltd., London, England. (Brit. No. 8746 of 1915.)

FOUNDRY—Apparatus for Drying Sand. James C. Davis, Hinsdale, Fred C. Henke, St. Louis, and William H. Hawley, Granite City, Ill., assignors to American Steel Foundries, New York, N. Y. (U. S. No. 1,151,667; Aug. 31, 1915.)

FURNACE-CHARGING APPARATUS. William F. Clark, Coraopolis, Penn. (U. S. No. 1,153,605; Sept. 14, 1915.)

IRON AND STEEL INGOTS, Improvements in Treating. B. Talbot, Middlesborough, England. (Brit. No. 2639 of 1915.)

JIGS—Discharging Means for Jigs. Samuel V. Tench, Lansford, Penn. (U. S. No. 1,153,527; Sept. 14, 1915.)

KILNS—Improved Lining for Rotary Kilns or Furnaces. Dynamidon G. M. B. H., Mannheim-Waldhof, Germany. (Brit. No. 11,824 of 1914.)

KILNS—Improvements in and Relating to Rotary Kilns for Burning Cement, Ores and Like Material. G. Polisius, Dessau, Germany. (Brit. No. 17,146 of 1914.)

LAMP—Miner's Safety Lamp. Martin Albrecht, Frankfort-on-the-Main, Germany. (U. S. No. 1,153,003; Sept. 7, 1915.)

METAL COATING—Apparatus for Melting and Spraying Fusible Substances. Franz Herkenrath, Zurich, Switzerland, assignor, by mesne assignments, to Metals Coating Co. of America, Boston, Mass. (U. S. No. 1,151,586; Aug. 31, 1915.)

METAL COATING—Galvanizing Bath. Nicholas King Turnbull, Manchester, England. (U. S. No. 1,151,629; Aug. 31, 1915.)

NODULIZING—Method of Treating Ores. Louis C. Drefahl, Cleveland, Ohio, assignor to the Grasselli Chemical Co., Cleveland, Ohio. (U. S. No. 1,153,203; Sept. 14, 1915.)

OIL-BURNING SMELTING FURNACE. Oliver P. Moore, Spokane, Wash. (U. S. No. 1,153,561; Sept. 14, 1915.)

PEAT—Method of Removing Water from Peat. Thomas Rigby, Dumfries, Scotland, assignor to Wetcarbonizing Ltd., London, England. (U. S. No. 1,151,825; Aug. 31, 1915.)

PHOSPHORUS—Process of Producing Sulphides of Phosphorus. Francis C. Frary, Minneapolis, Minn. (U. S. No. 1,153,054; Sept. 7, 1915.)

PNEUMATIC TOOL. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,152,624; Sept. 7, 1915.)

PUMP—Balanced Centrifugal Pump. Ferdinand W. Krogh, San Francisco, Calif. (U. S. No. 1,153,321; Sept. 14, 1915.)

REGENERATIVE FURNACES—Improvements in and Relating to Reversing Regenerative Furnaces. L. L. Knox, Pittsburgh, Penn. (Brit. No. 17,584 of 1914.)

ROASTING—Improvements Relating to the Roasting of Sulphide Ores and Similar Metallurgical Products. W. Buddeus, Charlottenberg, Germany. (Brit. No. 29,042 of 1913.)

SAMPLING—Automatic Sampling Device. Robert Hamilton, Birmingham, Ala. (U. S. No. 151,682; Aug. 31, 1915.)

SCRAP—Apparatus for Recovering Metal Scrap. George E. Wisener, Steubenville, Ohio. (U. S. No. 1,152,867; Sept. 7, 1915.)

SCREEN for Ores and Coal and Other Material. Edward S. McKinlay, Steamboat Springs, Colo. (U. S. No. 1,153,804; Sept. 14, 1915.)

SCREEN—Pulsating Screen. Edgar B. Symons, Chicago, Ill. (U. S. No. 1,151,976; Aug. 31, 1915.)

SEPARATION—Apparatus for Separating Minerals and Like Materials. Friedrich Arthur Maximilian Schiechel, Frankfort-on-the-Main, Germany. (U. S. No. 1,151,722; Aug. 31, 1915.)

SEPARATOR—Fine Coal and Ore Separator. John Marriott Draper, Manchester, England. (U. S. No. 1,151,448; Aug. 24, 1915.)

SEPARATOR—Ore Separator. Charles H. Brown and Charles C. Parker, Eureka, Utah. (U. S. No. 1,152,351; Aug. 31, 1915.)

SKIP DUMP. Charles L. Lawton, Hancock, Mich. (U. S. No. 1,151,955; Aug. 31, 1915.)

SLIMES—A Process for the Treatment of Slimes and Colloidal Masses and for the Recovery of the Metalliferous Contents of Ores, Tailings, Middlings and Concentrates. A. A. Lockwood, Surrey, England. (Brit. No. 174 of 1915.)

SLIMES—Apparatus for Thickening Slimes. William Armor Stedman, Wonder, Nev. (U. S. No. 1,153,722; Sept. 14, 1915.)

SLIMES—Improvements in and Relating to the Filtration and Treatment of Ore Slimes. C. Butters, Oakland, Calif. (Brit. No. 9921 of 1914.)

STAMP MILLING—Cam for Stamp Batteries. Arthur B. Foote, Grass Valley, Calif. (U. S. No. 1,152,161; Aug. 31, 1915.)

STEEL—Improvements in or Relating to the Production of High-Grade Steel and Slag Rich in Soluble Phosphates. Deutsche-Luxemburgische Berg Werks- und Hütten Akt., Bochum, Germany. (Brit. No. 27,868 of 1913.)

STEEL—Improvements in Reversible Regenerative Furnaces for Use in the Manufacture of Steel and the Like. J. S. Atkinson, Ditton Coke-Oven Machinery Co., Ltd., and K. Huessener. (Brit. No. 27,678 of 1913.)

SULPHATES—Process of Extracting Sulphurous Acid and Oxides from Sulphates. A. Bambach, Cologne, Germany. (Brit. No. 3,174 of 1914.)

SULPHIDES—Process for Treating Metallic Sulphides or Sulphide Ores. N. M. Hooton, Burton-on-Trent, England. (Brit. No. 18,007 of 1914.)

SULPHUR MINING. Herman Frasch, New York, N. Y., assignor, by mesne assignments, to Union Sulphur Co., Jersey City, N. J. (U. S. No. 1,152,499; Sept. 7, 1915.)

SULPHURIC ACID—Improvements in the Manufacture of Sulphuric Acid. Fr. Curtius & Co., Duisberg, Germany. (Brit. No. 28,550 of 1913.)

TEMPERING—Method and Apparatus for Tempering Metals. Julius A. Dyblie, Joliet, Ill. (U. S. No. 1,151,675; Aug. 31, 1915.)

TUNGSTEN—Method of Treating Tungsten Ores. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., Niagara Falls, N. Y. (U. S. No. 1,153,594; Sept. 14, 1915.)

WASHER—Magnetic Ore Washer. Edward W. Davis, Minneapolis, Minn. (U. S. No. 1,153,037; Sept. 7, 1915.)

WASTE HEAT—Recovering the Waste Heat of Smelters and Kindred Plants. Carl Semmler, Wiesbaden, Germany. (U. S. No. 1,151,831; Aug. 31, 1915.)

WELDING—Electric Welding Machine. Friederich Müller, Hartford, Conn., assignor to Pratt & Whitney Co., Hartford, Conn. (U. S. No. 1,151,706; Aug. 31, 1915.)

WELDING—Method of Welding. Jean Hubert Louis De Bats, Zelienople, Penn. (U. S. No. 1,152,610; Sept. 7, 1915.)

ZINC—Arrangement for Preventing the Formation of Smoke in the Production of Zinc. Alexander Roitzheim, Duisburg-Ruhrort, Germany. (U. S. No. 1,152,050; Aug. 31, 1915.)

ZINC—Improved Process for the Manufacture of Metallic Zinc or Zinc Oxide. H. W. Baron de Stuckle, Dieuze, Alsace Lorraine, Germany. (Brit. No. 28,188 of 1913.)

ZINC—Improved Process for the Manufacture of Receivers for Zinc Furnaces and the Like. Tellus Akt., f. Bergbau und Hüttenindustries, Frankfurt a. M., Germany. (Brit. No. 17,557 of 1914.)

ZINC—Reduction of Metallic Oxides and the Like. Frank William Highfield, Caversham, England. (U. S. No. 1,153,786; Sept. 14, 1915.)

ZIRCONIUM ALLOY and Process of Producing the Same. John Louis Brown, Baltimore, Md., assignor to Edward R. Cooper, Baltimore, Md. (U. S. No. 1,151,160; Aug. 24, 1915.)

PERSONALS

F. W. Harbord is now chief metallurgist to the British Ministry of Munitions.

F. R. Weekes will be in Darwin, Calif., for the next two months on professional business.

Robert M. Keeney has taken a position with the Standard Chemical Co., Canonsburg, Penn.

Edward L. Brayton, president Pelton Water Wheel Co., San Francisco, was in New York last week.

R. B. Lamb, formerly of Toronto, has moved his office temporarily to Room 1615, 27 Cedar St., New York.

L. V. Emanuel is now with the River Smelting & Refining Co., Florence, Colo. H. H. Utley is manager of the company.

Andrew C. Lawson, professor of geology, has been appointed dean of the College of Mining, University of California.

George H. Garrey is in Goldfield, Nev., to make a geological study of conditions in the property of the Goldfield Merger Mines Co. there.

R. O. Hocking has accepted a position as inspector of mining operations with the Meriden Iron Co., Hibbing, Minn., on the Mesabi Range.

Charles Perkins, purchasing agent of the Russian government, who is also an oil expert, recently visited the oil fields in South Alberta, Canada.

Montrose L. Lee sailed from Rio de Janeiro, Brazil, on Sept. 8 on his way to Bordeaux, France. He will spend two or three months in Europe, principally in Spain and France.

Homer D. Williams, now general superintendent of the Duquesne Works, will be president of the Carnegie Steel Co. in place of Alva C. Dinkey, who goes to the new Midvale company.

E. P. Earle and David Fasken, directors, and R. B. Watson, engineer, of the Nipissing Mines Co., have gone to inspect a gold discovery recently made north of Le Pas, Manitoba, which is reported to be remarkably rich.

Charles Sagert has been made superintendent of the open-hearth steel plant of the Brier Hill Steel Co., Youngstown, Ohio, to succeed Edward Bailey, who has gone with the Algoma Steel Co. at Sault Ste. Marie, Ontario.

Alva C. Dinkey, for a number of years president of the Carnegie Steel Co., has resigned and has been chosen president of the Midvale Steel Co. as reorganized. William E. Corey, who was chosen president last week, becomes chairman of the board.

B. B. Thayer, who was invited to sit on the Board of Engineers to investigate the conditions in the New York subway after the accident, declined, saying that his duties as member of the new Naval Advisory Board prevents his taking up the work.

Harry Huntington Miller, manager of the Compañia Anonima Minera lo Increible, has returned from a recent trip to Caracas and New York, and is again in charge of operations at the company's mines in El Callao district, Yuruary, Venezuela.

Dr. James Douglas, of New York, has made a donation of $150,000 to McGill University, Montreal, for the erection of a students' residence. Dr. Douglas has been offered the position of Chancellor of Queen's University, Kingston, Ont., and it is understood that he will accept it.

Russell A. Cowles has resigned his position with the American Brass Co. and has been elected a director and vice-president of the Buffalo Copper and Brass Rolling Mill, operating a brass and copper rolling plant at Buffalo, N. Y. Mr. Cowles has also been elected recently president of the Metals Trading Corporation.

Joseph W. Richards, professor of metallurgy at Lehigh University, South Bethlehem, Penn., was the guest of the Lehigh Intermountain Alumni Association at a luncheon at the University Club, Salt Lake City, Sept. 27. Professor Richards stopped over in Salt Lake on his way east from San Francisco. Nine alumni were present.

B. L. Miller, professor of Geology of Lehigh University, and Jos. T. Singewald, Jr., of Johns Hopkins, are making an extended tour, covering a period of 10 months through South America examining mines and deposits. Their trip includes a visit to the iron mines of Tofo, operated by the Bethlehem Chile Iron Mines Co., situated in the province of Coquimbo, Chile.

OBITUARY

John G. Bright died in Pittsburgh, Sept. 23, aged 79 years. He had lived in or near Pittsburgh for 61 years. He was for many years connected with the iron industry and assisted in the establishment of the first tinplate plant in Ohio.

William L. Hurd died at his country residence, near Valencia, Sept. 26, aged 68 years. He was born at Port Lavaca, Tex., and educated at Brown University, Providence, R. I. For 12 years he was with the National Tube Works Co. at McKeesport. He then connected himself with the Continental Tube Co., and later held a leading position with the Duquesne Tube Works Co. In 1897 he engaged in the iron and steel commission business at Pittsburgh with Hugh H. Davis, as Hurd, Davis & Co., and in 1899 organized and became president of the Monongahela Tube Co., which position he filled at the time of his death.

John W. Bookwalter, whose name was quite prominent in the steel trade about 25 years ago, died Sept. 27 at San Remo, Italy, aged 77 years. While engaged in the manufacture of the Leffel turbine water wheel at Springfield, Ohio, in 1888, he introduced from France the Robert-Bessemer process, installing a converter in the plant of the Bookwalter Casting Co., established for the manufacture of steel castings. The converter of this type attained considerable popularity, and it was introduced into quite a number of steel foundries in various parts of the country. For the past 15 years Mr. Bookwalter has spent most of his time in Europe.

SOCIETIES

American Institute of Mining Engineers—The first annual meeting of the Utah Section was held Oct. 4, at Salt Lake City. The order of procedure was as follows: Dinner (informal) and election of officers. Paper, "Notes on Flotation," by J. M. Callow. Paper, "Underground Mining at Utah Copper Mine," by T. S. Carnahan. Moving pictures of copper mining, milling and smelting. The officers chosen were: C. W. Whitley, chairman; Walter Fitch, vice-chairman; Ernest Gayford, secretary and treasurer.

Utah Society of Engineers—Following the summer intermission, this society has resumed its regular meetings, which are held monthly, every third Friday. The papers for four successive meetings—including the first, of Sept. 17—are as follows: "Engineering and Architecture," by H. D. Bowman, engineer of building construction; "Irrigation Pumping," by W. H. Trask, irrigation engineer, Utah Power & Light Co; Nov. 19, "Coal-Dust Firing," by F. M. Seddon, superintendent of the Portland Cement Co.; "The Possibilities of Smoke Prevention by the Use of Powdered Coal," by W. H. Kelsey, smoke inspector; Dec. 17, "The East Cañon Creek Dam," from the construction standpoint, by A. F. Parker; from the designers' standpoint, by C. J. Ullrich. The meetings are held at the Consolidated Music Hall. Recently a stereopticon was purchased by the society.

American Mining Congress—The report of the Utah committee on freight and ore treatment rates, read at the American Mining Congress in San Francisco, recommends a getting closer together of operators and smelter men; that there be closer coöperation between ore shippers and the railroad companies in disputes relative to freight rates. Before the report was submitted efforts had been made to ascertain definitely if any ore shipper had not received proper treatment at the hands of either smelters or railroad companies; and mine operators throughout Utah were requested to report any grievances to the Utah Chapter of the American Mining Congress. No replies of any kind were received by the committee. Efforts are being made to show the railroad companies that a reduction in rates upon low-grade ores would result in an opening up of ores of higher grade, which would give the railroads the advantage and opportunity of charging higher rates, which the ore could stand. The Tintic district of Utah is referred to in illustration. The committee recommends that assayers be instructed to refer small producers to smelters for the actual market value of ores, based on smelting rates, instead of on the gross value of the metals, based on hand samples as given by the assayers. The committee was composed of I. Pett, H. S. Joseph, George H. Dern, W. M. Ferry, and Arthur Thomas.

Columbia University—Courses leading to the degree of Chemical Engineer have been offered in the Department of

Chemistry of Columbia University for the past 10 years but, in recognition of the rapidly increasing importance of those industries based upon the applications of chemistry, and the consequent demand for men specially trained in the fundamental engineering practices as applied to the problems of industrial chemistry, the trustees of Columbia University have established a separate Department of Chemical Engineering upon the same plane of importance in the graduate engineering school as mining, civil, electrical and mechanical engineering. The head of the new department will be M. C. Whitaker, who has been professor of chemical engineering at Columbia University for the past five years. The new chemical-engineering laboratories which were recently installed, where the students are taught to use engineering methods and engineering appliances in the study and development of chemical industry, will be provided with still further equipment during the present summer. These laboratories are equipped with apparatus to illustrate the various fundamental operations of chemical and electro-chemical processes, and the student learns by actual contact to apply fundamental scientific principles to industrial problems. Here research may be conducted on such a scale as to establish the dependable engineering data necessary for intelligent and accurate process design.

INDUSTRIAL NEWS

The Asbestos Protected Metal Co., of Pittsburgh, Penn., announces the removal of its Detroit office to 2011 Dime Bank Building.

William Jay Turner has been appointed general counsel of the Lehigh Coal and Navigation Co., effective Oct. 1, 1915, vice Samuel Dickson, deceased.

The American Steel Foundries has installed a six-ton electric furnace of the Heroult design at its Indiana Harbor, Ind., plant for the manufacture of extra-quality steel castings.

The American Steeel and Wire Co. has been awarded a grand prize by the Panama-Pacific International Exposition for the superiority of its products and the high character of its exhibit.

W. E. Hardy, for the last 11 years connected with the Diamond Rubber Co. and the B F. Goodrich Co., has been appointed sales manager of the Boston Belting Co., Boston, Mass., manufacturers of mechanical rubber goods.

The Bucyrus Co. announces the appointment of the Union Construction Co., 604 Mission St., San Francisco, Calif., as its agent for the sale of placer dredges in western United States, western Canada and Alaska.

The Hardinge Conical Mill Co. has received an order from the Nevada Consolidated Copper Co. for two 8-ft. Hardinge mills, to be used with iron balls, also an order from the Dome Mines Co., Ltd., of South Porcupine, Ont., Canada, for two 8-ft. ball mills. These ball mills are to take the place of stamps now in use at the Dome company's plant.

Frederick T. Snyder, president of the Snyder Electric Furnace Co., 53 W. Jackson Blvd., Chicago, Ill., will deliver a paper before the October meeting of the American Chemical Society in Pittsburgh, describing an electric furnace for carrying out industrial operations at temperatures above 2,000° C., with a holding capacity of 10 cu.ft. of charge.

Bausch & Lomb Surveying Instruments received the Grand Prix at the Panama-Pacific Exposition for "general design and excellence of quality." Among the features of these instruments which secured for them the highest award are: recalculated lens system with maximum apertures; interior focusing; water-proof construction; tarnish-proof graduations and the tubular tungsten magnetic needle.

The Nordberg Mfg. Co., Milwaukee, Wis., announces that it has recently received orders for electric hoists from the following mining companies: Anaconda Copper Mining Co., Canadian Copper Co., Mond Nickel Co., Ray Consolidated Copper Co., United Verde Extension Mining Co., Consolidated Arizona Smelting Co., Magma Copper Co., Cerro de Pasco Mining Co. and Morococha Mining Co.

New Heroult electric furnaces have been contracted for as follows: The Latrobe Electric Steel Co., Latrobe, Penn., will add a 3-ton furnace to its equipment. It is operating a 6-ton Heroult furnace for producing special and tool steels. The Belle City Malleable Iron Co., Racine, Wis., is to install a 3-ton furnace in its steel castings department to make steel castings. It is now using the crucible process. The Buchanan Electric Steel Co., Buchanan, Mich., will add a 2-ton furnace. It is now operating a 3-ton Heroult furnace. The Buckeye Steel Castings Co., Columbus, Ohio, has contracted for a 6-ton furnace.

A new publication has just been issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, which should be of a high degree of interest to all who are giving attention to the problem of the extension of our trade abroad. It is entitled "Financial Developments in South American Countries," and reviews in about 40 pages of a clear and forcible style the situation as regards the currency, the money market, the principal banks, and the general condition of business in Argentina, Bolivia, Brazil, Chile, Peru, and Uruguay, during the last two or three years. Especial emphasis is placed on the results of the European war and the measures taken by the various governments, financial institutions, and commercial communities to meet the situation thus created. The author of this publication is William H. Lough, vice-president of the Alexander Hamilton Institute, who has recently made a trip through the countries treated. It is to be had from the superintendent of documents, Government Printing Office, Washington, D. C., for the price of 5 cents.

TRADE CATALOGS

The Connersville Blower Co., Connersville, Ind. Catalog No. 17. Gas Pumps, Exhausters. 64 pp., illus., 9x12 inches.

Tate, Jones & Co., Inc., Pittsburgh, Penn. Circular No. 148. October, 1915. Shells and Shell Furnaces. 8 pp., illus., 11x8½ inches.

Alberger Pump and Condenser Co., 140 Cedar St., New York. Bulletin No. 20. Hammond Water Meters. 24 pages, illus., 6x9 inches.

A. D. Granger Co., 90 West St., New York. Bulletin No. 2. Oswego Internally Fired Water-Tube Boilers. 16 pp., illus., 8x10½ inches.

The Denver Engineering Works Co., Denver, Colo. Bulletin No. 1064. "Dewco" Sample Grinder. 4 pp., 8½x11 inches, illus. Bulletin No. 1073. Richards Pulsator Riffle. 8 pp., illus., 8½x11 inches.

Link-Belt Co., 39th St. and Stewart Ave., Chicago, Ill. General Catalog No. 110. Elevating and Conveying Machinery, Power Transmission Machinery, Crushers, Etc. 576 pages, illus., 6½x9½ inches.

Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 1096. Direct Current Motors and Generators. 16 pages, illus., 8x10½ in. Bulletin No. 1412-A. Crushing Rolls. 32 pages, illus., 8x10½ in. Bulletin No. 1635. Hydro-electric Plant of the Cerro de Pasco Mining Co. 16 pages, illus., 8x10½ inches.

International High Speed Steel Co., 99 Nassau St., New York, N. Y. Catalog Mining and Rock Drill Steel. Hollow and Solid. 56 pp., illus.; 6x4¼ inches.

While this is primarily a catalog of tool steels, including drill steel, there is a great deal of information in the general subject of annealing and tempering that makes it a small "tool-steel handbook." Every user of tool steel ought to have it.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., OCTOBER 1, 1915,
of The Engineering and Mining Journal, published weekly at New York, N. Y., required by the act of August 24, 1912.
Editor, Walter Renton Ingalls, 10th Ave. at 36th St., New York, N. Y.
Managing Editor, Donald M. Liddell, 10th Ave. at 36th St., New York, N. Y.
Business Manager, L. E. Ives, 10th Ave. at 36th St., New York, N. Y.
Publisher, Hill Publishing Company, 10th Ave. at 36th St., New York, N. Y.
Owner, Hill Publishing Company, 10th Ave. at 36th St., New York, N. Y.
Owners of 1% or more of Stock Issued.
John A. Hill, 10th Ave. at 36th St., New York, N. Y.
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Fred S. Weatherby, 1600 Beacon St., Brookline, Mass.
Frederick A. Halsey, 356 W. 120th St., New York, N. Y.
G. Eugene Sly, 50 Union Sq., New York, N. Y.
Frederick W. Gross, 215 E. 11th St., Erie, Pa.
Alfred E. Kornfeld, 10th Ave. at 36th St., New York, N. Y.
Emma B. Hill, 80 Munn Ave., East Orange, N. J.
The balance of the stock issued (less than 1% each) is owned by 70 employees, 4 ex-employees, and 13 others who are wives, daughters or relatives of employees.
Known bondholders, mortgagees, and other security holders holding 1 per cent. or more of total amount of bonds, mortgages or other securities. Mortgage on building held by Dime Savings Bank, Brooklyn, N. Y.
C. W. Dibble, Vice-President,
HILL PUBLISHING COMPANY.
Sworn to and subscribed before me this 30th day of September, 1915.
RICHARD L. MURPHY,
Notary Public.
(My commission expires March 30, 1917.)

Editorial Correspondence

SAN FRANCISCO—Sept. 29

The Mine in the Mines and Metallurgy Building at the Panama-Pacific Exposition has from the opening day attracted a large number of visitors, particularly at the hour when the mine rescue work is demonstrated. The numerous underground features in gold, copper and coal mining and the various installations of mining machinery, most of which are operated for demonstration, afford to the lay visitor an opportunity to form a fairly good idea of what an actual underground mine is like. It was believed that this exhibit would attract only the lay visitor but the records show that not only a large number of mining enginers, but enginers and managers in high position have also availed themselves of the opportunity of observation and study. Young mining engineers and students found many features of practical mining detail here demonstrated much to their edification. The surface equipment of The Mine is not so complete in suggestion as it might have been, but the Bureau of Mines was obliged to work with such facilities and appropriation as were available. The wooden headframe is a fairly good one, but it is by no means a model. In fact there should have been a steel headframe instead and there might have been, had the builders been alive to the opportunity offered by this exhibit. There are few steel headframes in use at California mines, and this state is not alone in this lack of advancement. There are many small operators in the Pacific Coast mining regions who have never seen a steel headframe, who would have been glad to see an example in the Mines and Metallurgy Building at the Exposition. Another disadvantage in the surface suggestions is that while there are plentiful examples of coal there are no metal-bearing ores displayed, so that the visitor unacquainted with the situation underground forms an idea that he is going into a coal mine only. That is the fault of mining men who failed to provide a display of ores. But beyond this the exhibit as a whole is very creditable and of value to the mining industry as well as of interest to those who go merely to see what a mine looks like. The moving pictures of mining and metallurgical methods are also a feature that can be enjoyed by the lay visitor and studied with profit by the miner.

DENVER—Oct. 1

Nederland, only a small mining camp in the Rockies, has become famous through the prevailing and unusual market prices for tungsten ores. This is the chief settlement in the Boulder County tungsten belt and is teeming with activity. There is not a vacant house and hotel space is at a premium. Two lines of auto stages run daily between Nederland and Boulder, while the Denver, Boulder & Western Ry.—the Switzerland Trail—carries more pasengers than ever before if we except tourist travel. Miners are even giving renewed attention to a portion of northern Gilpin County (immediately south of the Boulder County line) where they recall having noticed a heavy black unidentified mineral in their early-day prospecting for gold.

W. S. Van Sant, general manager of the Copeland Ore Sampling Co., Victor, disappeared a week ago and thereby caused considerable gossip in the district. He is remembered as having driven away from Victor in his auto with a party of friends but his whereabouts is a mystery. Van Sant's predecessor was G. E. Copeland, then proprietor of the establishment, who was accidentally shot, a few years ago, in the Brown Palace Hotel, Denver, by Frank H. Henwood. Last winter, at the time of the first carload shipment of very rich ore from the famous Cresson "vug," the press of the country carried reproductions of the famous check issued in payment for this ore by the Copeland company, bearing Van Sant's signature.

SALT LAKE CITY—Sept. 30

A Greater Interest in Unlisted Stocks is being shown in the trading on the Salt Lake Stock and Mining Exchange. The total weekly business transacted in unlisted stocks during the past 3 weeks was: For the week ended Sept. 11, 204,739 shares, valued at $48,854; for the week ended Sept. 18, 211,550 shares, valued at $57,852; and for the week ended Sept. 25, 414,845 shares, valued at $100,037.

A New Dividend Payer has been added to Utah mines in the Cardiff, situated near the head of Big Cottonwood, which has just declared the initial dividend of 25c. a share, payable Oct. 1. Dividend aggregated $125,000 on the 500,000 shares issued. Shipments of 160 tons of ore a day, valued at between $4,000 and $5,000, are being made, but the average output is around 125 tons daily. The Cardiff opened ore last October, and has developed an orebody 225 ft. long by 20 ft. wide by 200 ft. on the dip.

Shipments from Alta now amount to three and four cars daily, or about 130 tons of ore, which is sent out over the Salt Lake & Alta R.R. The South Hecla is shipping 80 tons, including shipments by leasers; the Michigan-Utah, Wasatch Mines, and Alta Consolidated are also shipping. There has been some talk recently of building a narrow-gage cog railroad from Wasatch to Alta over the former narrow-gage grade a distance of 8 mi. Of greater immediate interest, however, is the possibility of an aërial tramway, which is being seriously considered. Two plans are under consideration: One for a tramway 8 mi. long from Wasatch to Alta, and the other for a tramway, about 4½ mi. long from Alta to a short distance below Tanners' Flat. The Salt Lake & Alta R.R. has a switchback at the granite quarries at Wasatch, and the railroad could be extended with a moderate grade to the latter point. Surveys for this have already been made, and the plan is found to be feasible at a moderate cost. This 4½-mi. tramway and extension of the railroad appears to meet with greater favor. It is estimated that such a tramway could be built at a cost, not exceeding $60,000 to $80,000. The season is rather far advanced for construction work, although the lower part of the cañon will probably be free from snow up to November or December. The plans under consideration call for the best material obtainable, and a good substantial tramway.

SEATTLE—Sept. 29

Nome Placer Mining Season, lasting usually about 100 days, was cut short this year for nearly the entire month of August on account of a long dry spell. This has not affected the average production which has been maintained by the district since 1898, with the exception of three years when the annual output went to nearly $6,000,000, due to the strike on the third beach line which is 4 mi. long. Many individual miners are operating placers this year on the tundra, the work extending over a strip of territory 10 mi. long and 4 mi. wide. The placer mining season is now closed permitting of an accurate estimate of the year's yield which is placed at close to $3,450,000.

Development Proves Permanency of Valdez Mines. Many events which loom big in the mining industry of Valdez have transpired recently. The big tram of the Granby mine has been started up and in a short time 300 men will be employed in the copper mine four miles from there. The Granite mine has struck a 4-ft. lead on the 600-ft. level and the output of the property will be more than doubled, with cheaper cost of handling the ore. The lead was struck on the Three-In-One property near Shoup Bay, and the future of the claims seems assured. The Fidalgo-Alaska copper claims on Shoup Bay have been turned to a syndicate of Spokane, Wash., mining men. The Valdez Mining Co. will let a contract soon for the extension of their lower tunnel. While the Granite mine has been a big producer for months, the striking of the lead in the 600-ft. tunnel adds greatly to the value of the property, insuring ore for many years, and allowing for more economical working of the claims. Operations on this group are being pushed rapidly by Superintendent W. R. Millard. The Granby mines are in charge of Superintendent Smith who has a large crew at work, and will continue development and the work of putting the properties on a shipping basis. The wharf and bunkers have been completed and the first ore sent down to the smeltery. Enough ore has been blocked out to last for several years. Jeff Devinney and M. F. Hendricksen are the principles in the bonding of the Three-In-One properties. E. D. Reiter, who is in charge of the work at the Fidalgo-Alaska claims, is making arrangements for the purchase of considerable additional equipment. A new wharf and bunkers are now under way. Many other claims are working. The Rutherford & Ramsay mine is being worked night and day, with the output heavy, and will continue working until the end of the season. H. Ellis has a crew on the Cliff mine and

a new lead has been uncovered and ore is now being crushed at the mill. The Dickey property on Landlock Bay and the McIntosh copper claims on Fidalgo Bay are producing steadily.

Sluicing Nome Tundra from the present beach line to the foot of Anvil Mountain, a distance of more than 10 mi. is the latest plan of interests in Nome backed by the Pioneer Mining Co. of which Jafet Lindeberg, discoverer of Nome, is the president. It is planned to strip each one of the seven beach lines so far uncovered and practically sluice them into Bering Sea. Arrangements are now being made for the carrying out of what will be the largest hydraulicking job ever undertaken in Alaska. Large reservoirs will be constructed in the Grand Central Basin on the east side of Anvil Mountain through which the water will be carried by tunnel to penstocks on the mountain which will give it a head of 340 ft. From here a ditch will be constructed from 20 to 100 ft. deep running to the seashore, part of this emptying into the present Miocene ditch, now one of the largest in the country, having a capacity of several thousand inches. This ditch picks up the water at the head of Nome River and delivers it to Anvil Creek. Below the tundra from Snake River to Hastings Creek, a distance of about 12 mi., and from the present seaboard back to the foothills, a distance of about 4 mi., the ground is seamed with auriferous sands. In many places these sands are not sufficiently rich to warrant their operation by the ordinary methods and in other places where they are fabulously rich, they cannot be worked by ordinary methods because of the inflow of water. All, however, are amenable to profitable operation by hydraulicking, and the big waterway will be used to obtain the gold that is now unobtainable. One of the ancient beach deposits which was discovered in 1904 yielded many millions of dollars, but a large portion of the streak has never been operated because it is impossible to shut off the flow of water. By cutting a bedrock ditch through the tundra to the sea, a task made possible by the conversion of the Grand Central waters, the overflow from which will be turned into Nome River, all of this ground will be drained. The Pioneer Mining Co., which is conceded the biggest placer mining company in Alaska, will start active work the first part of next season and will work a crew of about 300 men on the ditch and the necessary reservoirs.

KELLOGG, IDA.—Sept. 27

The Old English Board of Directors of the Northport Smelting and Refining Co. resigned in a body on Sept. 23. The new board elected immediately at Wallace is composed of E. K. Knight, Jerome J. Day, Eugene R. Day, Edward Boyce, and F. M. Rothrock. Jerome J. Day was elected president and Eugene R. Day secretary-treasurer, thus linking the management very closely with the Tamarack-Custer and Hercules mines and recalling a previous report that the $600,000 surplus of the Tamarack-Custer would be used by the new owners to finance the reconstruction of the smeltery. The work of overhauling plant is proceeding rapidly, 150 men being employed. A new flume is being built to supply water to the town of Northport and the works. New lead furnaces of 600 tons daily capacity are planned. Two largest of old copper furnaces, capacity 150 tons each, are being repaired. The equipment has been ordered from the Traylor Engineering Co. The Northport smeltery besides treating the Hercules and Tamarack-Custer ores will do a custom business, as is indicated by the installation of copper furnaces. Although it is hoped to have part of plant ready in 60 days, at least four or five months will be required to finish rebuilding.

Mines on the North Fork of the Coeur d'Alene River are making steady progress, and an effort is being made to secure daily train service to the junction at Enaville in place of the tri-weekly service now maintained by the O.-W. R. & N. The Empire Copper Mining Co., operating the Horst-Powell mine on the Little North Fork, is shipping three cars of copper ore a week. Development work extending over several years has disclosed a large orebody that can be shipped. A wagon road has recently been built from the mine to the mouth of Little North Fork at a cost of $10,000 and it is believed that the railway will soon extend a branch up the creek to the mine. Ore from both the Tuscumbia and the Idora is concentrated at the Idora mill and the concentrate is hauled 9 mi. to the railway at the mouth of Beaver Creek. The Tuscumbia is shipping eight cars of lead concentrate a month and the Idora two. Charles Conn, lessee on the Terrible Edith, last week shipped two cars of zinc ore and expects to send out a car a week hereafter. The Chicago-London company, which has the Black Horse mill under lease, is temporarily closed down on account of a shortage of water. They have until recently shipped four cars of zinc concentrate a month and expect to do better when milling is resumed. Shipments from this district will be greatly increased when the Ray-Jefferson completes its 250-ton mill at the forks of Beaver and Carbon creeks. It is rumored that the O.-W. R. & N. railway will build a branch to the mill.

HOUGHTON—Oct. 5

Production of Copper from Michigan Mines will run over 24,000,000 lb. for September, keeping close to the sustained high figures of last six months. Calumet & Hecla may run a little more than last month because the regrinding plants are again in full swing. Copper Range continues at its record-breaking output for 1915, running the highest percentage of copper ever secured from the Champion mine and far above any other mine in the district. Champion is making better than 50 lb. copper to the ton; Baltic and Trimountain close to 30. Total rock output from these mines is not so large, all rock being handled at two stamp mills, practically, but the selection is careful and close. Quincy's deeper levels are showing higher copper returns. South Kearsarge is furnishing the richest and largest tonnage from the Osceola Consolidated and the rock tonnage from the various mines of this corporation is limited only by mill capacity, everything working to the limit. Wolverine may show a slight increase for September; Isle Royale likely will run up to 900,000 lb. and Allouez's output will be at least 875,000 lb. for the month. It is considered the best of the Calumet & Hecla subsidiary investments at the present time. Franklin is increasing shipments steadily now, running average of 450 tons of rock daily and there is an improvement in the average of copper content. Franklin's conglomerate is running 20 lb. to the ton. Shipments are about 1,100 tons daily. More Calumet & Hecla shafts will go on three shifts this week. On Oct. 10 No. 13 and No. 16, on the Osceola lode, Calumet & Hecla, will go on three shifts. There has been a notable increase in the shipments of silver to the mint from the Calumet & Hecla. The figures will prove interesting if the increase in silver continues in 1916 as it has this year.

HIBBING, MINN.—Oct. 2

Upwards of 130,000 Tons Per Day being shipped from Hibbing district, of which Hull-Rust and Mahoning pits jointly contribute one-half. Figured into 50-ton cars, this daily tonnage means 2,600 carloads. At that, operations are somewhat curtailed because of lack of vessel capacity at docks. Next week's shipments will exceed above figures if weather conditions permit.

BRAINERD, MINN.—Oct. 2

Much Activity on the Cuyuna Range is manifest in the district, but the greater part of this is being exercised in an endeavor to uncover known tonnage; but little exploratory drill work is under way. Inside the village limits of Ironton, in Sec. 3, 46-29, a prospect shaft is going down on the June Lake property. The Adbar Development Co. is sinking a plank-lined operating shaft 4 mi. east of Brainerd, not far distant from the Wilcox. The Adams shaft, at Orelands, is being unwatered. At the Mahnomen and Hill Crest pits, stripping is being rushed. The small concentrator at the Cuyuna-Sultana is in operation and some shipments have been made. The Croft shaft at Crosby is cutting a station.

TORONTO—Sept. 27

An Extensive Deposit of Zinc Ore is reported to have been discovered by Denis Callahan, a Haileybury, Ont., prospector, near Burbridge Lake in the Upper Gatineau district of Quebec. John D. Macfarlane, mining engineer, has gone to inspect the discovery and bring out samples.

An Important Gold Discovery on the west side of the Pinewood River, 10 mi. from Athapapuska Lake, in northern Manitoba, by Don Messiers and Ralph Hammel, two former Cobalt prospectors, is reported to the Manitoba government. The prospectors are stated to have uncovered a rich lode of sulphide ore assaying $25 to the ton. The veins are said to be 2,000 ft. long and of remarkable width.

In the Kowkash Gold Field a number of new discoveries are reported, indicating that the gold belt is at least 25 mi. in length. Gold has been found near Redmond Station on the National Transcontinental Ry., 12 mi. west of Kowkash Station, and discoveries have also been made at a point about 8 mi. northeast from the original find, and near the shores of O'Sullivan's Lake an additional 5 mi. further on in the same direction. Free gold has been found along Gold Creek, 6 mi. southwest of the King Dodds claims. Development is being pushed by the Syndicate which holds the option on the latter and some promising veins have been uncovered. The surrounding claims are being worked and many quartz veins and stringers have been exposed. A rich discovery of silver is reported at Collins near Armstrong on the National Transcontinental about 100 mi. from Kowkash. The government is preparing a map and report on the Kowkash country.

The Mining News

ALASKA

KENNECOTT COPPER (Kennecott)—Mine production for four months ended Sept. 30 was 31,000,000 lb., or at the rate of more than 90,000,000 lb. a year. Production in September was approximately 8,000,000 lb. Alaska Steamship Co. has bought two steamers, which will be used to carry Kennecott's ore now being shipped to Tacoma and Garfield plants of American Smelting and Refining Co.; Tacoma plant unable to handle mine's entire output. Some of the ore is being sent to Perth Amboy for smelting.

CALIFORNIA

Amador County

KEYSTONE (Sutter Creek)—Eighty men are employed and 40 stamps are dropping on good ore. C. R. Downs is manager.

PINE GROVE (Pine Grove)—Shoot of ore 4 to 6 ft. wide reported. Development of property is in progress. Russell Robinson is superintendent.

PLYMOUTH CONSOLIDATED (Plymouth)—Company report for August shows 10,800 tons of ore milled yielding total value of $53,236 or average of $4.93 per ton. Operating expense $29,198; development $1,906; total $31,104, leaving surplus of $22,132. James F. Park is superintendent.

Butte County

GOLDEN BANK-GOLDEN QUEEN (Forbestown)—Extraction and milling of ore has been resumed under lease by Charles W. Reese. Lease carries purchase option on which payment must be made in October. Property is largest of old producers in Forbestown and was reopened about four years ago by M. J. Cooney after being idle for about 18 years. Large amount of development was done and property examined by large investors and would probably have been sold but for advent of European war. Reconstructed 20-stamp mill is driven by water power, as mills were in the early days in Forbestown district. Should this property be sold and operated on proper scale an electric power plant will be necessary. If this property is reopened and operated reopening of entire district will follow.

Calaveras County

ROUGH DIAMOND (Angels Camp)—This gravel mine has been developed to bed rock, to depth of 61 ft. Gravel is dark blue and prospects from 5c. to 15c. per pan. An incline is being sunk to follow bedrock into channel believed to be old Murphy's channel.

Eldorado County

MOREY (Placerville)—Property is being worked by Elwood Morey. A 5-stamp mill which is one of oldest in state and is said to have been running almost continuously for 45 years. Ore is high-grade.

BLACK SAND discovered in the bed of Hanktown Creek within limits of Placerville recently gave return of $110.90 from 97 lb. of sand. It is believed there is large deposit of high-grade black sand in creek.

MOUNT PLEASANT (Placerville)—This old mine near Grizzly Flats is being unwatered with view of resuming development in lower levels, lowest being at 1,100-ft. depth. Assessment of 8c. per share has been levied on the capital stock, delinquent Oct. 7. Mine was good producer years ago but was never worked extensively below 600 level.

W. S. DAY (Placerville)—A purchase bond has been taken by Nipissing Mining Co. at price reported to be $100,000. Reported that prospecting will be done with diamond drill. Ore is generally good-grade, running as high as $20 per ton. If development warrants purchase and operation it is probable that cyanidation will be introduced. H. E. Bush is superintendent.

MIOCENE OIL (Maricopa)—Gusher was brought in on 4, 11-23 recently and when it became evident that big producer was about to be finished, work was stopped and preparations made to bring well under control. Company has thus avoided large immediate production without tankage. Oil sand was entered at depth of 3,904 ft. Well is situated on Pat Welch lease.

Mariposa County

HART (Madera)—High-grade ore reported to have been disclosed in 2-ft. ledge extending for 30 ft. Ore contains copper as well as gold. Sample shipped to Selby. Property is owned by S. D. Hart.

Mono County

STANDARD (Bodie)—Work of treating old dumps is said to be preliminary to resumption of development of this and other mines in Bodie district.

Monterey County

PATRIQUIN (Parkfield)—Mine is producing about 1½ tons of ore per day. Recovery of about 60 flasks of quicksilver per month is reported.

Nevada County

THOMAS (Colfax)—Irving F. Smith and associates, of Oakland, have taken over the property and will begin development immediately.

EMPIRE AND GOLDEN CENTER threatened litigation reported settled out of court. It is also reported that negotiations have been resumed for settlement of Empire-North Star controversy out of court.

WALKESHAW (North Bloomfield)—In driving new drift Nels Jepsen and Theodore Larsen opened up large volume of water from which they escaped by being warned of approach by seepage through drill holes. They were compelled to run distance of 1,000 ft.

CARTER (Nevada City)—Reported that Haggin and Hearst interests have made an inspection of these claims at Missouri Bar on South Yuba River. Large ledge recently disclosed which produced good ore. Development will proceed under superintendency of Stuart Rawlings.

UNION HILL (Nevada City)—Fourth battery of mill in commission, making total of 20 stamps droping on ore. Most of the ore comes from 700 level and 770 intermediate level, averaging about $7.50 per ton. Monthly output of bullion $12,000 to $15,000. Small amount of tungsten.

Plumas County

HENRY TAUNT AND J. P. BUTRE, operating gravel claims on Squirrel Creek, recently cleaned up $900 in coarse gold, one of pieces weighing about 9 oz. This district has produced large amount of coarse gold, recent slug valued at $700.

San Luis Obispo County

AVILA REFINERY has been removed to Casmalia in northern part of Santa Barbara County where it will be used in manufacture of asphalt from heavy grade of oil produced in that field which had been abandoned by fuel-oil producers.

COLORADO

Boulder County

WHITE RAVEN (Ward)—In sinking shaft below 240-ft. level body of rich silver and bismuth ore has been opened, at what appears to be convergence of two oreshoots which have been opened in higher levels.

BOULDER TUNGSTEN (Nederland)—Work on Clark tunnel is well under way and timbering of loose ground near portal is in progress. Machine drills will be used as soon as new compressor plant has been installed. Foundations for compressor and mine buildings have been laid and buildings are under construction. Portal of the tunnel is located below the Nederland dam of the Colorado Power Co. and line of tunnel is directed in northwesterly course which will intersect veins at depth of 1,000 ft. below the surface. F. H. Nye is superintendent.

Clear Creek County

WYOMING VALLEY TUNNEL (Idaho Springs)—The company plans to resume active development work. New 8-drill air compressor is to be installed.

VINDICATOR TUNNEL (Idaho Springs)—The 6-ft. vein in Tom Tuck property has been opened for distance of 250 ft. Arrangements are in progress to provide capital for extensive development, and to cover cost of machinery to complete equipment of old Gold Hill mill, which is to be remodeled to treat ore from tunnel.

Lake County

LEADVILLE DISTRICT MILL (Leadville)—Zinc tails from old Adams mill in Strayhorse gulch are being hauled by Horrigan Bros. and are treated by flotation in this reconstructed mill now operated by Pingree Mining and Milling Co. Estimates place dump tonnage at 10,000.

San Juan County

CARLSON (Silverton)—Main adit on sulphide vein has opened large body of soft sulphide ore, much of which is high grade and can be shipped crude.

KITTIMAC (Eureka)—Manager Walter, of Denver, and Superintendent Card have decided to install flotation in the mill in addition to Huff electrostatic process.

HAMLET (Middleton)—Remodeled mill is now in operation. Ore is trammed from mine 200 ft. through snow shed to mill storage bins. Ore is broken in Blake crusher and passed to two sets of rolls and revolving screens; then treated on roughing table to eliminate part of gangue and passed to Hardinge mill. Pulp goes to classifier and thence to four sets of Wilfley tables. Slime is pumped to Callow tank for dewatering and thence to 6-cell flotation machine. E. A. Ritter is consulting engineer.

Summit County

NO. 2 BOAT OF THE TONOPAH PLACERS CO. exposed four different veins in the bed of Swan River recently and prospectors have staked out claims along the extensions up Muggins Gulch.

Teller County

WAR EAGLE (Altman)—After lying idle for 10 years, this mine in highest part of district is being reopened by Charles Dougherty. It produced high-grade liberally in former operations.

MORNING GLORY (Anaconda)—New leasing concern is pushing development on 225 level after installing electric hoist and laying compressed-air pipeline from Doctor-Jack Pot power plant.

TORNADO (Cripple Creek)—Development will soon be resumed in this Raven Hill property belonging to Elkton estate. Surface equipment is being installed and shaft will be repaired and placed in working order.

IDAHO

Shoshone County

GUELPH (Wallace)—Caledonia compressor, motor and hoist have been purchased for this company and connections are being made with power mains.

INTERSTATE-CALLAHAN (Wallace)—For 26 days ending Sept. 5, this company shipped 4,600 tons of concentrate and crude ore, averaging about 49% zinc.

OOM PAUL (Burke)—Company will use 500-ft. Echo tunnel as start for 4,000-ft. crosscut adit. New buildings, including bunkhouse, mess-house, and compressor-house, have been completed.

NORTHERN LIGHT (Pine Creek)—Crosscut and drift from bottom of 200-ft. shaft has exposed vein 6 ft. in width, nearly all of which is commercial ore, with 15 in. of shipping ore along foot wall. Ore is both lead and zinc, former predominating.

OOM PAUL (Burke)—Crosscut 4,000 ft. in length is now being driven to cut vein 1,000 ft. below old shaft workings on opposite side of mountain. New and permanent buildings have been completed and company is well equipped to make rapid progress. Crosscut will run through ground of Echo Mining Co. and will cut vein on that property at great depth.

EMPIRE COPPER (Little North Fork)—Empire Copper Mining Co., which owns property formerly known as the Horst-Powell, is shipping three cars of copper ore per week, hauling by wagon five miles to railroad. Company spent $10,000 building wagon road, which is built on railroad grade, and it is believed that O.-W. R. & N. company will extend branch to mine next year.

LITTLE PITTSBURG (Pine Creek)—Gus Smith has just bonded Little Pittsburgh group of claims to J. D. and Watson Beebe, who have incorporated Colonial Mining Co. for purpose of development. Ledge is open at depth 400 ft. by crosscut and drift of 25 ft. has exposed 14 ft. of zinc ore that averages 25%; 7 ft. of which averages 45%. Compressor has been ordered and electric power line is being extended to property.

FRISCO (Gem)—Mine closed down three weeks to install new crusher, rolls and other machinery in mill. Owned by Federal company. Working zinc ore left in mine years ago by former owners when zinc was of little value. Extensive experiments treating ore during past year or more said to be successful. Mill processes include concentration, magnetic separation and flotation. New body of lead and zinc recently struck on 2,200 level.

SNOWSTORM (Mullan)—Mine exhausted ore reserves and suspended operations several months ago, having surplus of $160,000 in treasury. Reliably reported today that surplus will be used to take over Banner lead property near Troy, Mont., which has been under development for several years by Leo Greenough, manager of Snowstorm. Fred McCormick, formerly superintendent of Snowstorm, has gone to Troy to take charge of property.

NATIONAL (Mullan)—Crosscut from bottom of 200-ft. winze sunk from inner end of the old working adit has entered vein 35 ft., opening highest-grade copper ore ever found in mine. There is no indication of hanging wall, but no further crosscutting will be done till new pumps have been installed to handle increased flow of water expected when hanging wall is reached. The 500-ton mill will soon be ready to operate and there is said to be sufficient ore broken in stopes to keep it running at capacity for several months.

CALEDONIA (Kellogg)—Connection between upper workings and Keating tunnel has opened orebodies at considerably greater depth and is said to have assured sufficient ore to maintain dividends at present rate of 3c. a share, or $78,150 a month, for at least five years. Four feet of lead-silver ore assaying higher than any considerable body heretofore discovered in mine has been opened by new level 70 ft. above Keating tunnel. Where raise cut vein a foot of first-class copper ore was found, and this is said to have widened to several feet of milling ore, with stringers of shipping ore.

INDEPENDENCE-GETTYSBURG (Mullan)—Independence-Gettysburg group of claims, adjoining Morning mine of Federal company, was recently taken over by Independence Lead Mines Corporation, of which Maurice W. Bacon, general manager for Stewart Mining Co., is president. More than 4,000 ft. of development has been done. Fifteen men are employed, stripping apex of supposed extension of Morning vein, driving on Independence at depth of 600 ft. and on Gettysburg at 150 ft. It is rumored that eastern capitalists are negotiating for two-thirds of 1,000,000 shares issued, on basis of 25c. per share.

MICHIGAN

Copper

AHMEEK (Ahmeek)—Has foundations in for new shaft rockhouse at No. 2. This will not interfere with hoisting but will give greater capacity when completed.

SOUTH LAKE (Houghton)—South Lake's suspension of rock shipments is due simply to desire to accumulate dozen cars at time to facilitate railway transportation from Copper Range to Hancock and Calumet roads.

HOUGHTON (Houghton)—Has resumed hoisting rock and shipping to Winona mill. Winze will be sunk from 10th to 12th level. Best showing is south of 6th level. Practically all copper rock is coming from that point now.

CALUMET & HECLA (Calumet)—Two-men machines are entirely out of use excepting in some pillar work. While the "one-man" drill was made an issue in strike two years ago no man would go back to old drill now. Calumet & Hecla now has on payrolls over 10,000 men.

WHITE PINE (ONTONGAN)—Last Friday made its record showing for a single day since operations started. The mill turned out 40 bbl. of mineral, each barrel weighing 1,300 lb. of mineral or 52,000 lb. per day. Assuming that mineral shows a refined return of 70%, an assumption warranted by facts, product for one day's operation is shown to be 36,000 lb. refined copper. Mill was not then operating to complete capacity.

Iron

SALISBURY (Ishpeming)—Long drift to new orebody to south has been completed. Raising is now in progress. Exact size of deposit is unknown as only one drill showed ore.

FORBES (Iron River)—New blacksmith and machine shop to be erected soon. Present structures are entirely inadequate. Electric hoist, pump and underground haulage to be installed.

NORTH LAKE (Ishpeming)—Contract has been let for power house at new Section 6 mine of North Lake group. First cut has been made in pit. Stripping should be finished early in year. Ore will be milled. Deposit contains about 250,000 tons.

VOLUNTEER (Palmer)—Mine was reopened this week. Had been closed more than year but pumps had been kept going. New shaft has been raised. Drilling disclosed fine, new deposit. About 150 men will be employed when mine gets going well. Shipping also started this week.

JONES & LAUGHLIN (Ishpeming)—Small pit at Iron Mountain Lake has been opened again. Some work done here four years ago. About 12,000 tons will be shipped. Some exploratory work will also be done. Work on new underground property, short distance away, will probably be resumed in November. More drilling will be done on this property.

LAKE ANGELINE (Ishpeming)—Cleveland-Cliffs Iron Co. making surface survey of this property, which was bought at auction from Pittsburg & Lake Angeline Iron Co., Sept. 15. Old workings will be scrammed. Development campaign will be planned shortly. Believed there is ore to be found there. Machinery is almost worthless. Lucien Eaton, superintendent of Ishpeming district, will have charge.

PENN IRON (Vulcan)—Hydro-electric shovel has been loading ore from stockpiles for some time and is giving excellent satisfaction. It operates very smoothly and is said to be a big improvement over straight electric shovels. There is not wear and tear on motors when maximum load is on, as is case with electric machines. Patents have been secured by Frank Armstrong, designer.

MINNESOTA

Duluth

MINNESOTA STEEL (Duluth)—Officials state that plant will be in readiness to start on schedule time, Nov. 1. After month's firing with fuel oil, coke ovens are nearly ready. Although no ore shipments are yet arriving, upward of 300 cars of limestone and coal are being received daily. Blast furnace and hot-blast stove linings now being dried, as well as openhearth furnaces. Company recently contracted for erection of $50,000 hospital and $40,000 store building. Hospital will be 4-story structure, and store building will be 187x187 ft., two stories. Both will be of concrete blocks.

Mesabi Range

MORTON (Hibbing)—A new shaft has been completed.

ALEXANDRIA (Chisholm)—Arthur Iron Mining Co., employing 40 men on shift, now down 52 ft.

HILL ANNEX (Calumet)—About 300 ft. of trestle collapsed Sept. 27, carrying down ten cars. No fatalities.

THORNE (Buhl)—This new underground mine of Steel Corporation made its first shipment Sept. 23.

SUSQUEHANNA (Hibbing)—New shaft completed and drifting started. This main drift runs directly under openpit.

QUINN-HARRISON (Nashwauk)—Much rock being encountered in stripping operations. Eight shovels working.

LEETONIA (Hibbing)—Oliver Iron Mining Co. has completed new shaft and is now preparing to drift under Carson Lake.

MAHONING (Hibbing)—On Oct. 1 mine passed the 1,800,000-ton mark for season. Either Mahoning or Hull pit will be season's biggest shipper.

VICTORIA (Virginia)—Republic Iron & Steel Co. has started diamond-drill operations on property, immediately east of Norman mine.

TIOGA (Chisholm)—Contract for furnishing light and power to this new operation of Shenango Furnace Co. has been awarded to Chisholm Electric Co. Latter company is building an addition to its plant for this purpose.

OLIVER IRON MINING (Chisholm)—Is shipping complete outfit for exploratory shaft sinking from its Sec. 27 shaft at Chisholm to Schullsburg, Wis., at which point shaft will be put down in zinc district. At Sec. 27 mine temporary equipment has been superseded by permanent installation.

HAWKINS (Nashwauk)—Company has notified all its surface lessees to remove their buildings by Nov. 1 as the company plans stripping west bank. This will bring openpit within few feet of town's principal business street, Central Ave. Overburden at point is 40 ft. deep.

MISSOURI—KANSAS—OKLAHOMA

ATHLETIC MINING (Duenweg, Mo.)—To enlarge mill to 350 tons capacity. Larger compressor also to be installed. After contemplated improvements plant will be largest and most complete in district.

HANFORD MINING (Joplin, Mo.)—Is sinking new shaft east of its plant in Jackson Hollow, southwest of Joplin. Has made several improvements in plant recently and is now making about 60 tons of ore weekly.

GRAY CAT MINING (Galena, Kan.)—Started up last week after shut down of month, installing new steam hoist and making some repairs on mill. Made two cars of zinc ore; assayed 61%, sold for $80 on 60% base.

JAMES MURPHY LAND (Galena, Kan.)—Mines completely flooded by heavy rains; hundred of miners out of work. Large concrete flume in Short Creek which crosses the land, insufficient to carry water off, arrangement being made to install two Texas Wonder pumps; expect to have water out in about six weeks.

MONTANA

Jefferson County

KING SALOMON (Clancy)—This property, located in Clancy district, has been taken over by Monarch Mining and Smelting Co., with ample capital for financing property, which is one of old producers of district. Large amount of ore is blocked out in 400-ft. level for stoping. On 600-ft. level ore will be tapped by drift and crosscut. Mine is equipped with modern machinery good for depth of 1,200 ft. Regular shipments will begin shortly.

Silver Bow County

TUOLUMNE (Butte)—Strike of rich copper glance running as high as 40% copper was made Sept. 28 on 2,600-ft. level about 50 ft. from station.

NETTIE (Butte)—Pumping capacity at this mine, one of Anaconda company's properties in western section of Butte district, has been increased to take care of entire flow of water from underground workings, which is at present between 1,400 and 1,500 gal. per minute.

BUTTE-DULUTH (Butte)—On Sept. 29 Judge George M. Bourquin of the United States district court rendered a decision that the Butte-Duluth mining company of Butte is not bankrupt. Although company admitted that it was unable to meet its obligations as they matured, it did not admit that its liabilities exceeded assets.

BUTTE & LONDON (Butte)—Shaft sinking at this property has met with set-back through trouble with installation of new electric pump on 1,100-ft. level to take care of flow of water in mine. In meantime shaft is kept clear of water by use of pump on 800-ft. level and by supplementing with tank-skips whenever water makes any gains.

DAVIS-DALY (Butte)—Hesperus vein, opened on new 2,500-ft. level of Colorado mine, has been drifted on 150 ft. and ore is holding out well. Vein averages 12 ft. in width, and the commercial ore, which contains a good sprinkling of copper glance, is about 5½ ft. wide. Smelter returns showing an average copper content of 5½ per cent.

NORTH BUTTE (Butte)—Encouraged by steady increase in surplus, company is making preparations for development of some of its new properties purchased in Butte district in past two years. Regular quarterly dividend of 50c. was ordered paid, but there will be no advance of dividend rate as surplus will be kept for proposed improvements and developing of new properties. It is understood that cost of producing copper by North Butte has dropped below 10c. a pound. With new shaft in operation monthly output should increase to at least 2,250,000 lb. of copper, raising production to 27,000,000 lb. per annum.

NEVADA

Clark County

SULTAN (Goodsprings)—Henry Robbins, owner of this property, has announced his intention to erect 50-ton dry-concentrating plant at mine. Mill is to treat mixed lead and zinc carbonates, of which there is considerable tonnage blocked out in mine. Experiments are also to be made on concentration of low-grade zinc carbonates.

MOBILE (Goodsprings)—Now shipping about 250 tons of zinc-carbonate ore monthly. Owners have taken option on Doran & Zenzen property on Big Devil Mountain. Force of men are to be put to work at once. Property has considerable tonnage of ore exposed, carrying lead and silver. It is probable that mill will be erected in near future.

Douglas County

BUCKSKIN NATIONAL (Buckskin)—Has 5,000 tons ore on dumps. Will build mill as soon as sufficient depth is attained in mine to determine permanent character of ore.

Esmeralda County

DIAMONDFIELD BLACK BUTTE (Diamondfield)—The Howard Marine lease on 110-ft. level has cut rich ore. Face of drift said to average $240 per ton in gold and silver.

GOLDFIELD CONS. (Goldfield)—During August total production was 32,100 tons from which net realization was $106,624. During month lessees produced 992 tons of total gross value $23,085.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Reported that on south 1,200 level strike of 14 in. of $10,000 ore has been made. Is thought to be same streak which was 8 in. wide and assayed $5,300 on both 1,200 and 1,300 levels.

ROCHESTER MINES (Rochester)—Big Friedman tunnel is progressing at rate of 15 ft. a day and is now in 920 ft. Low-grade vein matter is being encountered. Ore zone expected to be encountered at depth of from 1,000 to 1,200 ft. according to original estimates when figuring dip of veins at 400 level. Tunnel will hit ledges at depth of 1,200 ft.

Mineral County

BELLEVILLE TAILINGS ASSOCIATION (Belleville)—This association composed of Goldfield mining men has been working on tailings from ores of Candelaria milled in early days of camp, since July of last year, laying off only during winter months. Plant cost $25,000 and has treated to date 20,000 tons of tailings. There remains at least 150,000 tons averaging around $5 to be treated. Force consists of 18 men and the plant treats about 115 tons daily. C. Beedle is manager.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 25 was 9,629 tons, valued at $199,282 compared to 9,861 tons week previous. Producers were: Tonopah Belmont, 2,833 tons; Tonopah Mining, 2,850; Tonopah Extension, 1,850; West End, 839; Jim Butler, 1,050; miscellaneous leasers, 207 tons.

TONOPAH BELMONT (Tonopah)—Combined statement of Development and Milling companies for quarter ended Aug. 31, shows receipts from ore and bullion $586,480; mining, milling, and administration expenses, $371,867. Total net income, including miscellaneous, for three months, $226,864.

Storey County

MEXICAN (Virginia)—South drift No. 3 on 2,500 level in porphyry and quartz. Mill treated Mexican and Union wedge rock.

BELCHER-CROWN POINT (Gold Hill)—Water at incline lowered 45 ft. and held at 170 ft. below the 1,500 level. Saved 20 cars of mill rock. Jacket mill received 977 tons of dump rock and shipped one bar of bullion.

CON. VIRGINIA AND OPHIR (Virginia)—Air and water pipe placed for a distance of 186 ft. below 2,500 level. Ophir continued raising to third floor in vein. Ophir saved 309 cars of ore from all work and milled 250 tons.

White Pine County

GIROUX CON. (Kimberley)—Col. E. A. Wall, of Salt Lake City, has filed petition at Reno, Nev., asking for receiver for Giroux Consolidated. He alleges conspiracy on part of Thomas F. Cole and others to depreciate value of property and asks for accounting. Restraining order issued. Hearing set for Nov. 10 at Carson City.

NORTH DAKOTA

LIGNITE OPERATORS of Burlington, N. D., have lodged complaint with state railway commission against the short haul rates recently promulgated. Date of hearing not yet set.

SOUTH DAKOTA

Lawrence County

HIDDEN TREASURE (Deadwood)—Crosscutting easterly and westerly on 200 level is revealing highly mineralized formations. Some native copper has been found.

MOGUL (Terry)—New De La Vergne engine has been put in commission, raising capacity of plant to 200 tons daily. Custom ore is treated for $1.50 per ton; settlement is made upon 75% of gold assay.

UTAH

Beaver County

CONSIDERABLE MINING AND DEVELOPMENT is being done in the vicinity of Milford. The Moscow, Cedar-Talisman, Lady Bryan, of the Utah Mining, Milling and Transportation Co., and Majestic mines are producing; and the Leonora, Paloma, and others are developing ore. It is reported that the Horn Silver dumps at Frisco will probably be turned over to a leasing company. The dumps contain over 200,000 tons, and some of the material carries about 7% lead, 6% zinc, and 6 oz. silver. The mill at the South Utah at Newhouse, which will treat the Cactus dumps by flotation is expected to start up in the near future.

Juab County

TINTIC ORE SHIPMENTS for week ended Sept. 25 totaled 130 carloads estimated at 6,500 tons, valued at $163,000, compared with 121 carloads week previous.

Summit County

PARK CITY ORE PRODUCTION for week ended Sept. 25 totaled 2,634 tons valued at $105,000, compared with 1,727 tons week previous. There were 5 shippers.

Tooele County

INTERNATIONAL SMELTING (Tooele)—A. J. Bruneau, representing 25 Tooele Valley farmers, has filed suit in United States Court at Salt Lake City against International Smelting Co. for specific performance of contracts to purchase lands near smelter. Suit involves $265,000 and $39,000 attorney fees. Contracts were made prior to building of smeltery and were to be exercised should damage by smelter smoke be proven.

CANADA

British Columbia

GRANBY CONSOLIDATED (Grand Forks)—Has taken bond on Gloucester group of claims in Gloucester camp, about 55 mi. from Grand Forks, and about 30 mi. from end of Kettle Valley R.R., to complete which an extension of time was granted by Government.

Ontario

BEAVER (Cobalt)—Diamond-drilling to depth of 1,700 ft. has proved occurrence of rich ore below present workings, and shaft is being sunk rapidly.

CHAMBERS FERLAND (Cobalt)—Has found vein carrying high-grade ore on 275-ft. level. Extension of this vein in Nipissing has been profitable producer.

SMITH-LEBINE CLAIMS (Sesekinika Lake)—Have been purchased by Montreal syndicate, headed by A. M. Bilsky. They have an area of 120 acres on which 18 veins have been uncovered.

DOMINION REDUCTION (Cobalt)—Has taken option on Brennan property at Goodfish Lake, and has also taken more options in Munro Township, where it already owns rich Dobie-Leyson property.

NIPISSING (Cobalt)—Has dropped its option on claims in Munro Township, near the Dobie-Leyson. Company has an option on property in California. Financial statement shows cash on hand $655,403 and ore and bullion on hand and in transit, $731,572.

MEXICO

Pachuca

SANTA GERTRUDIS (Pachuca)—Ore crushed during August amounted to 13,338 tons; estimated profit, £5,280.

AFRICA

Transvaal

GOLD OUTPUT IN AUGUST is reported at 778,763 oz. fine, which is 8,208 oz. more than in July, and 66,845 oz. more than in August, 1914. For the eight months ended Aug. 31 the total production was 5,530,165 oz. in 1914, and 5,957,167 oz., or $123,134,642, in 1915; an increase of 427,002 oz. this year. The number of negro laborers employed at the end of August was 206,809, an increase of 7,412 over July.

The Market Report

Metal Markets

NEW YORK—Oct. 6

There was not much change in the metal markets last week, save in the case of copper where some pressure to sell began to be exhibited. Lead was a little weaker in tone. The peculiar condition in spelter continued.

Replying to an inquirer, "regular terms" in the sale of copper mean that the seller delivers the copper to the buyer, paying the freight on it, and allows him 30 days after his receipt of the copper in which to make payment, or if he chooses to pay cash the bill is discounted at the rate of ½%. To arrive at the difference between a sale upon these terms and a cash sale, f.o.b. refinery, which is regarded as being f.o.b. New York, the interest on the value of the copper while in transit is commonly reckoned. This is a matter of 10 days. When copper sells at 18¼c., regular terms, the equivalent net price is therefore about 18.03c., there being 0.09125c. discount, 0.1c. freight, and 0.0304c. loss of interest, a total of 0.22c. The freight rate is naturally a variable, being less to some near-by factories and more to some of the more remote ones. About 10c. per 100 lb. is regarded as being an average transportation cost.

Copper, Tin, Lead and Zinc

Copper—Some of the principal producers who had made liberal sales at 18c., regular terms, raised their asking price to 18¼c., but the market never became established at that figure. At the beginning of our week of record several sales of one million pound lots were made to domestic consumers at 17⅞c., regular terms, at least two agencies participating in this business. At the same time producers made sales of considerable tonnages for export at prices netting above 18c. Later, foreign business was done in considerable volume at higher prices, but, at the same time, foreign business was taken at lower prices. With respect to this business much depended upon the points for which sales were made and the conditions otherwise. Some producers were fortunate in having copper already available on the other side, and others were fortunate in having contracted for freight room in advance. In the meanwhile the domestic market became rather dull and the producers of electrolytic copper began to feel keenly the competition of the Lake producers. The latter realized high premiums several months ago and have had dreams of getting them again, but apparently giving up such hopes, they have lately been offering Lake upon the same terms as electrolytic. Even so, they found the going not quite easy. During the time when Lake was so scarce, the producers of electrolytic took some trouble to find a foothold for their product in quarters where previously it had not been used. Now, when the Lake producers are trying to get back their old customers they are told in some cases, so it is said, that electrolytic copper is liked better. At the close of the week copper was offered in many quarters at 18c., regular terms, and in some quarters at 17⅞c., with intimations that even the latter price might be shaded.

The volume of business transacted during the week was moderately large. Sales to domestic consumers were probably in excess of 10,000,000 lb., and foreign business was probably larger than that.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19½@20c. per lb. at mill. The chief maker does not quote base price.

Tin—The market was dull up to Oct. 5, when rumors began to be circulated that the government of the Federated Malay States was going to put an export duty on tin. This news, which was first published in a New York daily paper, became the subject of cable inquiries to Europe which led dealers over there to surmise that something was in the air, and considerable excitement ensued. On Oct. 5 tin opened in this market at 32c. and closed at 32½c. On Oct. 6 there was a sharp rise in the London price, which was reflected by an advance in the price here.

Lead—At the opening of the week some lead realized a premium, but this could not be maintained in view of the free offerings by several large interests at the old price. Meanwhile the market in St. Louis became a little weaker. There was a good deal of inquiry for large tonnages of lead but these were freely met.

Spelter—The only change in conditions from our last report was the doing of considerable business for such deliveries as October-March, November-March, etc. Such business was done at about 11¾@12c. The total volume of business was rather large, and it was almost entirely for export, domestic consumers apparently having no interest in the market. A relatively trifling amount of business for early deliveries was done, the price for October being about 13¾c., for November, 13⅜@13½c., for December, 13@13¼c. Sales were made for the first quarter of 1916 at 10½@11½c.

Zinc Sheets—Business has been active, sales good but with no material change in quotations. The base price for carload lots is $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

Sept. Oct.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			17.80		4.50		12.75
30	4.7188	49½	@18.00	32½	@4.55	4.42½	@13.75
			17.70			4.37½	12.00
1	4.7225	49¾	@17.90	32¼	4.50	@4.42½	@13.75
			17.70			4.37½	11.75
2	4.7200	49¾	@17.80	32¼	4.50	@4.40	@13.75
			17.70				11.75
4	4.7150	49¾	@17.80	32	4.50	4.37½	@13.75
			17.65				11.75
5	4.6950	49¾	@17.75	32¼	4.50	4.37½	@13.75
			17.65				11.75
6	4.7000	49¾	@17.75	32¼	4.50	4.37½	@13.75

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Sept.-Oct.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
30	23⅞	72	73	87½	18.43	151¼	152½	23¾	5 02	65	13.70
1	23¾	73	73⅛	87½	18.44	150	151¼	24⅛	5 08	67½	14.22
2	23 11/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	23 11/16	72⅞	73⅛	88	18.53	149½	150½	23⅛	4.98	67½	14.19
5	23 11/16	72⅛	73⅛	88	18.45	148¼	149¾	23 7/16	4 92	69	14.35
6	23⅞	71	72	88	18.47	151⅜	152¾	23⅛	4.91	69	14.36

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

Other Metals

NEW YORK—Oct. 6

Aluminum—The demand continues good and the scarcity of metal for spot and early deliveries has been accentuated. Sales are reported as high as 49@51c. per lb. for No. 1 ingots. No quotations on futures are being made.

Antimony—A fair business has been done and there is a good lot of inquiries. Reports of large demand for war orders are current, but not especially credited. Ordinary brands, chiefly Chinese, bring 28@29c. per lb., New York; while 45@46c. per lb. is asked for Cookson's.

Nickel—Quotations for ordinary forms nominally are 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—Stocks are reported rather low, and the market is active and stronger. New York quotations are $90 per flask of 75 lb. for large lots; $91@92 for smaller orders. San Francisco reports by telegraph a brisk market, with sales early in the week at $85, the price hardening to $87.50@90 at the close. London price is unchanged at £16 per flask, with no discount from second hands.

Minor Metals—Current quotations for **Bismuth** are $3 per lb., New York.—**Cadmium** is quoted at 7s. per lb. in London; $1.75@1.90 per lb., New York.—**Chromium** metal, 75c. per lb., New York.—**Cobalt** metal, 97% pure, is sold at $2 per lb.—**Magnesium,** pure, has gone to a high price, $6 per lb. being asked.—**Selenium** varies from $2.50@3 per lb., New York, for large lots; $4.50@5 for retail quantities.—**Tellurium** is quoted at 80s. per lb. in London.

Gold, Silver and Platinum

NEW YORK—Oct. 6

Gold sales from the United States Assay Office in New York in September were $3,020,719, being $498,497 less than in August. For the nine months ended Sept. 30, the total sales were $48,409,521 in 1914, and $24,420,943 in 1915; a decrease of $23,988,578 this year.

Gold Imports in Great Britain eight months ended Aug. 31 were £6,934,244; exports, £6,679,991; excess of imports, £254,253. The receipts are apparently very much less than in 1914 owing to the arrangements by which gold in the Transvaal and Australia is held in those countries.

Platinum—The market is entirely in the air owing to the scarcity of supplies. Dealers are reluctant to quote, even to regular customers. On a nominal base of $50 per oz. sales have been made up to $58 and even $60. Quotations may be put at $57@60 per oz. for refined platinum, and $61@65 per oz. for hard metal.

Silver has been steady in London, and the amounts on the market have been absorbed at slightly advancing prices. There is no news, however, to indicate any material advance.

Silver Imports in Great Britain eight months ended Aug. 31 were valued at £6,479,285; exports, £5,426,759; excess of imports, £1,052,526, which compares with an excess of exports of £1,130,571 last year.

METAL EXPORTS AND IMPORTS

Imports and exports of minor metals in the United States, seven months ended July 31, in pounds, except platinum, which is in ounces:

	Imports		Exports	
	1914	1915	1914	1915
Nickel	24,000,060	29,057,243	17,845,959	18,463,253
Antimony	8,773,391	11,509,034	3,673	661,492
Aluminum	9,087,575	5,842,129	18,939	40,102
Quicksilver	.....	.....	9,141	128,837
Platinum	48,715	12,779	143	9

Nickel and antimony include contents of ore, matte, etc. Exports of aluminum manufactures not included above, were valued at $533,927 in 1914, and $2,4 2,124 this year. Exports include reëxports of foreign material. Imports of quicksilver not reported separately.

Exports and imports of the Principal Metals, other than iron and steel, in the United States, seven months ended July 31:

	Exports		Imports	
	1914	1915	1914	1915
Copper, long tons	266,963	180,145	93,056	73,741
Tin, long tons	455	472	27,198	28,005
Lead, short tons	41,009	79,846	13,576	29,671
Zinc, short tons	1,014	77,928	560	549

Exports include reëxports of foreign material. Copper includes contents of ore and matte. Imports of zinc ore in 1915 were 69,854 tons, estimated to contain 29,049 tons metallic zinc. Exports of domestic zinc ore were 605 tons.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Oct. 2

The open market base price paid this week for 60% zinc ore advanced from $72 to $76.50 per ton. Ore taken under contract sold up to $85 per ton. Medium grades sold in the open market at $68@72 base. One lot of 150 tons assaying 50% zinc and carrying 8% carbonate sold at $45 per ton. The base price paid for 80% lead ore was $50 per ton.

SHIPMENTS, WEEK ENDED OCT. 2

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,694,440	238,460	473,880
Year	148,206,040	4,781,620	20,494,190

Shipped during week to separating plants, 4,314,280 lb. zinc ore.

JOPLIN, MO.—Oct. 2

Blende, high price, $90; base, per ton of 60% zinc, premium ore, $87.50; medium grades, $87@85; lower, $84@80; calamine base, $60@56; car lots and ton lots, $55@50; average, all grades of zinc, $79.62. Lead, high price, $56.10; base, $55@50 per ton 80% metal content; average, all grades of lead, $50.62 per ton.

SHIPMENTS WEEK ENDED OCT. 2

	Blende	Calamine	Lead	Values
Totals this week	12,299,300	711,100	2,380,240	$578,220
Totals this year	433,005,410	33,645,780	67,721,880	$19,033,410

Blende value, the week, $498,690; 40 weeks, $16,488,510.

Calamine value, the week, $19,290; 40 weeks, $767,060.

Lead value, the week, $60,240; 40 weeks, $1,777,840.

Nearly 60 in. of rain this year is the government record for Joplin. Other portions of the district have experienced several heavy rains that did not visit Joplin. There has been no rain of importance since Tuesday, when a 3-in. fall visited the district east of Joplin, but was very light here. The water is very heavy in the mines, but the present outlook is more favorable for settled clear weather than any prospect this fall. All ore outside Granby has been sold, the shipment representing over 1,000 tons in excess of the production, while large quantities of ore were being contracted for future delivery today and tonight.

Iron Trade Review

NEW YORK—Oct. 6

The iron and steel trades show increasing activity and a stronger position. This is not due altogether to export business, since domestic orders are growing in volume. Structural-steel orders are coming in more freely, as building and bridge business seems to improve; the railroads are ordering more cars, and there is a considerable volume of orders for plates, shapes and other material for ship building. In some lines, such as bars, the orders exceed the capacity of the mills.

Under these conditions is is to be expected that the advances in price on finished steel should be held, and more are expected to be made soon.

There is a shortage of billets, blooms and half-finished steel and mills using purchased billets are anxiously looking for supplies.

Pig iron is stronger, though not yet as active as finished steel. The chief demand just now is for basic iron, foundry grades being rather quiet. The market is strong enough, however, to enable furnace managers to hold the advances they have already asked and to suggest further advances on first-quarter business.

Exports from Baltimore for the week included 5,459 tons billets, bars, wire rods and skelp steel to Great Britain; 2,501 tons steel rails to Archangel; 5,637 tons steel scrap to Naples.

Imports at Baltimore for the week included 322 tons ferromanganese from Great Britain, 6,900 tons manganese ore from Brazil.

It is now stated with some authority that Charles M. Schwab, president of the Bethlehem Steel Co., is negotiating for the purchase of the stock in the Pennsylvania Steel Co., the majority of which is owned by the Pennsylvania R.R. There are also reports that negotiations are going on for the sale of the majority stock in the Cambria Steel Co., an option on which is held by W. H. Donner and Henry C. Frick.

Foreign Trade of the United States in iron and steel, including machinery, is valued as below by the Department of Commerce for the seven months ended July 31:

	1914	1915	Changes
Exports	$129,816,919	$174,970,645	I. $45,153,726
Imports	18,752,973	11,731,263	D. 7,021,710
Excess, exports	$111,063,946	$163,239,382	I. $52,175,436

The increase in exports has been chiefly in the later months. In July the total exports were valued at $35,891,575, against $16,737,552 in July of last year.

PITTSBURGH—Oct. 5

The resignation of Alva C. Dinkey as president of the Carnegie Steel Co., to become president of the Midvale Steel Co. under its new ownership, astonished the steel trade of Pittsburgh, where it is recognized remarkable financial inducements must have been offered.

Pressure for steel has been increasing still more rapidly. Except in wire products and merchant steel bars there is no question of finishing capacity, the question being simply one of steel supply. Rolling billets are almost unobtainable, and forging billets have sold at fancy prices, even above $40 a ton.

Buyers are specifying very freely on all contracts and in most products the mills entered the fourth quarter with more than half their output specified, and with distinct prospects that specifications on fourth-quarter contracts will bring them to Jan. 1 with specifications for three months' work on books. There is a corresponding disinclination to write first-quarter contracts, though some such business is being done.

Consumptive demand does not appear large, except in relation to the steel supply, and there are many industries that could, in prosperity, consume much more steel than they are taking now. There is therefore a distinct possibility of such a shortage in steel as to cause a runaway market, with prices advancing sharply instead of, as in recent months, at about the rate that obtained in the 1909 and 1912 movements.

Steel bars are up to 1.40c., a level attained last week by shapes, while most mills are quoting plates also at 1.40c. Sheets are up $1 a ton to 2c. Wire products seem on the verge of another advance. Railroad spikes are up $2 a ton for prompt, to 1.60c., and are quoted 1.65c. for first quarter and 1.70c. for second quarter. Shafting is up to 60% discount as minimum, $2 advance in a week and $10 advance on this movement, with the makers practically filled for the remainder of the year.

Pig Iron—The pig-iron market presents a sharp contrast to the steel market. There have been no advances in the past fortnight or more, and present prices are not held with the greatest ease, while actual buying is very light. Consumers are apparently covered for the balance of the year. Sellers expect a general buying movement within about six weeks, for next year's delivery, but the current make appears sufficient for requirements, with quite a number of merchant stacks still idle. Foundry is $14.50 for early delivery and $15 for first half of 1916; malleable is $14.50@15, according to analysis. Bessemer and basic remain at $16 and $15 respectively. W. P. Snyder & Co. announce average prices obtained in September at $15 for basic, a gain of 63.6c. and $15.906 for bessemer, a gain of 84.2c. All prices quoted are f.o.b. Valley furnaces, prices delivered Pittsburgh being 95c. higher.

Ferromanganese—The market is rather quiet, contract material being quoted at $100 for foreign, delivery indefinite, and at $115 for domestic, with delivery assured, and prompt lots ranging between these extremes.

Steel—The market on billets and sheet bars has become nominal. There are no openhearth billets to be had at less than $26, maker's mill, Youngstown, and higher prices have been paid. Sheet bars are nominally $1 higher, while bessemer steel might be had at $1 under openhearth, but it is growing scarcer. Fancy prices are being paid for forging billets, even above $40, with an exceptionally heavy demand, making mills indisposed to quote on rolling billets. Rods are nominally $30, Pittsburgh.

FERRO-ALLOYS

Ferromanganese is quoted at $110@112.50 per ton for domestic 80% material. **Spiegeleisen** has been sold at $27 per ton for 20%, at furnace.—**Ferrosilicon,** 50%, is quoted at $75 per ton at Pittsburgh. Bessemer ferrosilicon is from $20 per ton for 10% up to $24 for 14%, all at furnace.—**Ferrotitanium** is 8@12½c. per lb., according to size of lots and delivery.—**Ferrovanadium** is $2@2.25 per lb. of contained vanadium.—**Ferrotungsten** is quoted in London at 7s.@7s. 6d. per lb.—$1.68@1.80—for alloy 75@80% tungsten.—**Ferromolybdenum** is quoted in London at 18s.—$4.32—per lb. for 75% alloy.

IRON ORE

Discussion of next season's prices for Lake ore is still going on, in view of the large demand for late shipments. It is generally believed that an advance of 50c. per ton will be asked.

Imports and exports of iron ore in the United States, seven months ended July 31 were, in long tons:

	1914	1915	Changes
Imports	850,883	671,039	D. 179,844
Exports	378,131	252,958	D. 125,173

The chief imports this year were 432,845 tons from Cuba, 120,307 tons from Sweden, and 27,008 tons from Spain. Exports were chiefly to Canada.

Imports of manganese ore for the seven months were 163,390 tons in 1914, and 87,136 tons in 1915; decrease, 76,254 tons. Reëxports of imported ore were 28 tons in 1914, and 2,238 tons this year.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 388,884 short tons; shipments, 387,018 tons. Shipments from the Greensburg and Upper Connellsville regions, 45,713 tons.

Connellsville—The contracting movement for furnace coke for 1916 delivery continues, but buyers are showing less eagerness than was expected, and deals are brought to a head slowly. About half a dozen contracts have now been closed, for the first half or all of 1916, involving about 75,000 tons a month. Some of these have been at flat prices, $2.25 and $2.35 respectively, while some operators are still talking $2.50. Other contracts have been closed on a sliding-scale basis, with 20% as much advance for coke as basic pig iron at Valley furnaces may advance, and on such a basis that pig iron at the present market of $15 would mean coke at $2.15; $15.50 pig iron, $2.25 coke and so on. Usually the scale runs down to a minimum of about $1.85, referable to $13.50 pig iron. Contracts now under negotiation are on about the same basis as those already closed. Spot furnace coke has stiffened 5c., being quotable at $1.80@1.85, per net ton at ovens.

Exports and Imports of Fuel in the United States, seven months ended July 31, in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	2,211,664	1,997,817	15,902	2,313
Bituminous	9,307,748	10,585,552	758,044	835,222
Coke	408,441	430,604	61,715	24,389
Bunker coal	4,525,876	4,354,037	.....	.....
Total	16,447,729	17,368,010	835,661	861,924

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The greater part of the trade, both exports and imports, is with Canada. There were considerable gains this year in exports to Brazil, Argentina and Italy.

Chemicals

NEW YORK—Oct. 6

The general markets seem inclined to be quieter outside of a few lines, but are rather steady.

Arsenic—Business is still rather slow, but with no change in quotations. Prices are $3.50 per 100 lb. for large lots, and up to $4 per 100 lb. for smaller orders.

Copper Sulphate—Business is steady and sales good for the season. The current quotations are $6.75 per 100 lb. for carload lots and $7 per 100 lb. for smaller parcels.

Nitrate of Soda—The market shows little change and business is fair. The current quotations are 2.42½c. per lb. for spot and 2.45c. for futures.

Pyrites—Imports at Baltimore for the past week included 6,921 tons pyrites from Huelva, Spain.

Imports and Exports of Chemicals in the United States, seven months ended July 31, in pounds:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	2,609,946	2,291,803	.....	8,825
Bleach	25,554,389	6,181,490	12,654	120,126
Acetate of lime	.....	.....	38,767,339	13,602,955
Calcium carbide	.....	.....	21,351,263	24,732,706
Potash salts	23,041,969	13,562,685	450,302	954,607
Sodium cyanide	.....	3,640,488	.....	1,737,987
Soda salts, value	$390,471	$299,905	$5,542	$22,346

Exports include reëxports of foreign material. This statement does not include nitrate of soda nor crude potash salts used chiefly as fertilizers.

PETROLEUM

The monthly report of the "Oil City Derrick" gives the number of new oil wells completed in September as follows: Pennsylvania grade, 336; Lima-Indiana, 41; Central Ohio, 73; Kentucky, 4; Illinois, 66; Mid-Continent, 371; Texas-Louisiana, 139. The total number of wells completed was 1,030; the total daily production, 101,875 bbl. There were 233 dry holes and 184 gas wells. As compared with August there was a decrease of 46 wells, but an increase of 4,025 bbl. in production. On Sept. 30 there were 2,130 wells drilling.

Imports of petroleum from Mexico into the United States in August were 2,039,159 bbl., being 460,512 bbl. more than in July.

Assessments

Company	Delinqe	Sale	Amt.
Bonanza Con., Utah	Sept. 15	Oct. 6	$0.015
Buffalo, Mont.	Sept. 10	Oct. 10	0.003
Cash Boy, Nev.	Sept. 29	Oct. 30	0.01
Central Eureka, Calif.	Oct. 8	Oct. 9	0.05
Coeur d'Alene, Ida.	Sept. 14	Oct. 14	0.002
Columbus Ext., Utah	Oct. 10	Oct. 30	0.025
Comstock, Ida.	Sept. 30	Oct. 30	0.001
Con. Virginia, Nev.	Sept. 28	Oct. 19	0.05
Diam'field Black Butte, Nev.	Oct. 4	Nov. 4	0.01
E. Hercules Ext., Ida. (post.)		Oct. 11	0.0015
Exchequer, Nev.	Oct. 4	Oct. 25	0.02
Four Timbers, Wash.	Oct. 4	Nov. 4	0.001
Gethin Le Roy, Utah	Sept. 25	Oct. 13	0.01
Giant M. & D., Ida.	Oct. 7	Nov. 8	0.003
Goldstrike M. & L., Utah	Oct. 1	Oct. 20	0.01
Great Bend Reinc., Nev.	Sept. 10	Oct. 10	0.01
Hancock Cons., Mich.	Jan. 3		1.00
Hector, Ida.	Sept. 4	Oct. 4	0.005
Idaho Nevada, Ida.	Sept. 7	Oct. 1	0.002
Idora, Ida.	Oct. 11	Nov. 11	0.005
Imperial, Ida.	Aug. 31	Oct. 1	0.005
LeRoy, Ida.	Sept. 25	Oct. 25	0.002
M. & P. Gold, Utah	Sept. 15	Oct. 12	0.0025
Mount Pleasant Con., Calif.		Oct. 7	0.08
Naildriver, Utah	Oct. 9	Nov. 8	0.02
Nevada Cooperative, Nev.	Sept. 15	Oct. 15	0.01
Nevada-Douglas, Nev.	Sept. 27	Oct. 20	0.10
New Arcadian, Mich.	Dec. 1		0.50
New Baltic, Mich.	Jan. 15		0.50
New Quincy, Utah	Sept. 2	Sept. 23	0.01
Northern Light, Ida.	Nov. 2	Dec. 2	0.004
Oom Paul Con, Ida.	Aug. 30	Oct. 4	0.01
Ophir, Nev.	Oct. 12	Nov. 2	0.05
Phedora, Ida.	Sept. 21	Oct. 21	0.0005
Phoenix, Mich.	Jan. 1		1.00
Pioche Metals, Nev.	Oct. 20	Nov. 20	0.00½
Rainbow, Ida.	Oct. 15	Nov. 20	0.002
Revelator, Utah.	Oct. 4	Oct. 25	0.00½
Rockford, Ida.	Oct. 4	Oct. 30	0.005
Royal, Ida.	Sept. 1	Oct. 1	0.001
Silver Moon, Ida.	Oct. 15	Nov. 18	0.005
Silver Pick Cons., Nev.	Oct. 16	Nov. 23	0.01
Snowstorm Ext.	Sept. 16	Oct. 18	0.003
Sunset M. & D., Nev.	Oct. 18	Nov. 22	0.02
Sunshine, Ida.	Oct. 15	Nov. 15	0.0006
Syndicate, Utah	Sept. 11	Oct. 2	0.001
Temple, Ida.	Sept. 20	Oct. 20	0.002
Tonopah Bonanza, Nev.	Sept. 13	Oct. 11	0.01
Union Cons., Nev.	Oct. 25	Nov. 15	0.05

Stock Quotations

The New York Exchange has listed $16,639,800 of American Smelters Securities, pfd. A.

COLO. SPRINGS	Oct. 4	SALT LAKE	Oct. 4
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.02½	Beck Tunnel	.06½
Cripple Cr'k Con.	.008	Black Jack	‡.05
C. K. & N.	‡.02	Colorado Mining	.03
Doctor Jack Pot.	.08½	Crown Point	.02½
Elkton Con.	.23½	Daly-Judge	6.65
El Paso	.75	Emma Cop.	.15
Findlay	.03½	Gold Chain	.15½
Gold Dollar	‡.01	Grand Central	.55
Gold Sovereign	.03½	Iron Blossom	.80
Golden Cycle	1.79½	Lower Mammoth	‡.00½
Isabella	.16½	May Day	.17
Jack Pot	.06½	Opohongo	.00½
Jerry Johnson	.04	Prince Con.	.59
Lexington	‡.005	Seven Troughs	.01½
Mary McKinney	.35½	Silver King Coal'n	3.32½
Pharmacist	.008	Silver King Con.	2.02½
Portland	1.56	Sioux Con.	.03½
Raven B. H.	‡.03½	Uncle Sam	.10
Vindicator	1.50	Yankee	.38

TORONTO	Oct. 4		
Bailey	.04½	Dome Exten.	.26
Chambers Ferland	.14	Dome Mines	21.75
Coniagas	4.00	Foley O'Brien	.30
Peterson Lake	.21	Hollinger	25.00
Right of Way	.03	Imperial	.05
Seneca Superior	‡.78	Jupiter	.11
Silver Queen	.01	McIntyre	.47
T. & Hudson Bay	20.00	Pearl Lake	‡.00½
Timiskaming	.38	Porcu. Crown	.75
Trethewey	.16	Preston E. D.	.04½
Wettlaufer-Lor.	.07	Rea	‡.09

SAN FRANCISCO	Oct. 4		
Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡.05	Belmont	3.50
Andes	.08	Jim Butler	.77
Best & Belcher	.05	Lone Star	.05
Caledonia	.59	MacNamara	.02
Challenge Con.	‡.04	Midway	.12
Chollar	.03	Mont.-Tonopah	.29
Confidence	.16	North Star	.11
Con. Virginia	.15	Rescue Eula	.09
Gould & Curry	.03	West End Con.	.55
Hale & Norcross	.05	Atlanta	.27
Jacket-Cr. Pt.	.14	Booth	.42
Julia	‡.03	C.O.D. Con.	.04
Mexican	.34	Comb. Frac.	.08
Occidental	.79	D'field Daisy	.03
Ophir	.22	Jumbo Extension	1.17½
Overman	.07	Pitts.-Silver Peak	.06
Potosi	.04	Round Mountain	.41
Savage	.06	Sandstorm Kendall	.10
Sierra Nevada	.23	Silver Pick	.07
Union Con.	.40	Central Eureka	.08

N. Y. EXCH.	Oct. 4	BOSTON EXCH	Oct. 4
Name of Comp.	Clg.	Name of Comp.	Clg.
Am.Sm.&Ref.,com	86½	Adventure	1½
Am. Sm. & Ref., pf.	108½	Ahmeek	398
Am. Sm. Sec., pf. B.	81	Alaska Gold M	32½
Anaconda	72½	Algomah	2½
Batopilas Min.	1½	Allouez	55
Bethlehem Steel	395	Am. Zinc	58
Bethlehem Steel, pf.	164	Ariz. Com., ctfs.	8½
Chino	46½	Bonanza	.30
Colo. Fuel & Iron	59	Butte-Balaklava	3½
Crucible Steel	103½	Butte & Superior	60
Federal M. & S., pf.	51½	Calumet & Ariz.	63½
Great Nor., ore., ctf.	47½	Calumet & Hecla	550
Guggen. Exp.	66½	Centennial	17½
Homestake	118	Copper Range	56½
Inspiration Con.	43	Daly West	2
International Nickel	219	East Butte	12½
Mex. Petroleum	89½	Franklin	8½
Miami Copper	33½	Granby	84½
Nat'l Lead, com.	68	Hancock	16½
National Lead, pf.	110½	Hedley	‡27
Nev. Consol.	15½	Helvetia	.35
Ontario Min	3½	Indiana	5
Quicksilver	‡2½	Island Cr'k, com.	44½
Ray Con.	25½	Island Cr'k, pfd.	‡88½
Republic I&S, com.	53½	Isle Royale	28
Republic I&S, pf.	103½	Keweenaw	2½
SlossSheffi'd, com.	61	Lake	13½
Tennessee Copper	65½	La Salle	5
Utah Copper	68½	Mason Valley	1½
U. S. Steel, com.	79½	Mass.	10½
U. S. Steel, pf.	114	Mayflower	4
		Michigan	2½
N. Y. CURB	Oct. 4	Mohawk	74
Alaska Juneau	11½	New Arcadian	9½
Alta Con.	.25	North Butte	29½
Beaver Con.	.26	North Lake	1½
Big Four	.05	Ojibway	1½
Blue Bell	.03	Old Colony	3½
Braden Copper	9½	Old Dominion	53
Buffalo Mines	.50	Osceola	84
Can. Cop. Corpn.	‡⅛	Quincy	83
Cashboy	.05	Santa Fe	3½
Chile Cop.	20	Shannon	6½
Con. Ariz. Sm.	1 1/16	Shattuck-Ariz.	27
Con. Coppermines	1½	Superior	27
Con. Nev.-Utah	‡.25	Superior & Bost.	2½
Dia. Black B.	.06	Tamarack	54
Florence	.45	Trinity	3½
Goldfield Con.	1 1/16	Tuolumne	.45
Goldfield Merger	.18½	U. S. Smelting	41
Greene Cananea	.38	U. S. Smelt'g, pf.	46
Kennecott Cop.	54½	Utah Apex	3½
Kerr Lake	3½	Utah Con.	12½
La Rose	7/16	Victoria	2½
Magma	14½	Winona	3
McKinley-Dar-Sa.	.33	Wolverine	58
Mines of Am.	2½	Wyandot	1½
Mother Lode	.36		
Nevada Hills	.18	BOSTON CURB	Oct. 4
New Utah Bingham	3½	Bingham Mines	7½
Nipissing Mines	7½	Boston Ely	.22
Oro	.06½	Butte & Lon'n Dev.	.30
St. Joseph Lead	12½	Calaveras	1½
South Utah	.35	Calumet-Corbin	.01
Stand'd Oil of N.J.	486	Chief Con.	.85
Standard S. L.	1½	Cortez	.42
Stewart	1 1/16	Crown Reserve	.37
Success	.86	Davis-Daly	1½
Tonopah	5½	Eagle & Blue Bell	1½
Tonopah Ex.	2½	First Nat. Cop.	2 1/16
Tonopah Merger	.34	Houghton Copper	2½
Tribullion	.25	Iron Cap Cop., pf.	4
Tularosa	‡½	Majestic	.75
Yukon Gold	‡2½	Mexican Metals	.20
		Nevada-Douglas	.75
LONDON	Sept. 15	New Baltic	2½
Alaska Tre'dwell	£6 12s 6d	New Cornelia	8½
Burma Corp.	1 13 1½	Ohio Copper	.11
Cam & Motor	0 12 9	Oneco	.80
Camp Bird	0 4 9	Raven Copper	.10
El Oro	0 7 0	Rex Cons.	.52
Esperanza	0 7 3	Smokey Dev.	.15
Mexico Mines	3 11 3	So. Lake	5½
Nechi, pfd.	0 12 6	Tonopah Victor	.28
Oroville	0 14 9	United Verde Ext.	5½
Santa Gert'dis	0 7 6	Utah Metal	8½
Tomboy	1 0 3		
Tough Oakes	0 6 6		

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	48.680	27.986	24.260	23.591
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.096	69.313	*
May	13.996	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	17.502	‡	68.915	‡	85.250
October	*		‡		‡	
November	11.739		53.227		*	
December	12.801		56.841		*	
Year						

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	33.125	‡	152.625
October	30.284		‡	
November	33.304		149.391	
December	33.604		147.102	
Av. year	34.350			

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	4.610	3.658	4.490	‡	23.151
October	3.528		3.384		‡	
November	3.683		3.585		18.500	
December	3.800		3.662		19.097	
Year	3.862		3.777			

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.962	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	13.440	5.230	13.270	‡	67.841
October	4.909		4.750		‡	
November	5.112		4.962		25.016	
December	5.592		5.430		27.369	
Year	5.213		5.066			

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.91	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	16.92	13.90	15.89	14.03	15.70
October	14.84		13.75		13.97	
November	14.59		13.43		13.83	
December	14.70		13.45		13.83	
Year	$14.88		$13.78		$14.01	